THE ELECTRICAL WORLD

A Weekly Record of Current Electrical Progress

PUBLISHED EVERY SATURDAY

AT NO. 9 MURRAY STREET, NEW YORK.

Telephone Call: Murray 586. Cable Address: "Electrical," New York.

New England Office, 48 Congress Street, Boston.
Western Office, 23 Borden Block, Chicago.

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SUBSCRIPTION, IN ADVANCE, ONE YEAR, $3.00.

(Postage Prepaid in the U. S. or Canada.)

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Subscription to foreign countries, $4 a year.

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The Editor of The Electrical World, New York.

Subscriptions and communications relating to Advertising or the Business Department should be addressed to

W. J. JOHNSTON, Publisher,
No. 9 Murray Street, New York,
OR EITHER OF THE BRANCH OFFICES.

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Vol. VI. NEW YORK, OCTOBER 31, 1885. No. 18.

ONE of our financial exchanges is very anxious that the Western Union Company should publish fuller statistics; and the Western Union Company in turn is dying to get a peep at the Baltimore & Ohio ledgers.

WE publish to-day another installment of Dr. Atkinson's valuable and interesting treatment of the subject of static electricity. It will be observed that the cuts, which we have made specially for this work, are of unusually fine character.

IT looks now as though the attempts to establish the invalidity of the Bell patent will be more prolonged than appeared likely not long ago. The Department of Justice has, with greater caution than it manifested at first, referred the new appeals for its help to the Department of the Interior, which, of course, will have to lend an ear to a great amount of evidence and argumentation before it can make up its mind what should be done in the premises.

GEN. C. H. BARNEY, the Secretary of the National Telephone Exchange Association, writes us that he has several orders for the Proceedings of the first and third meetings of the association, but is unable to fill them, none being in his possession, and he makes the following request: "Possibly some of your numerous readers may have spare copies, which they would be willing to exchange for those of the fourth, fifth and sixth meetings. If so, they would confer a favor by addressing me."

A FEW days ago there occurred a terrible accident on the Pennsylvania Railroad near this city. It was due to the mistake of a young, careful and hard-working operator, who at once surrendered himself to the authorities. The blame lies, we think, more on the manner of signaling than on the operator, who was anxious to expedite the service on that foggy morning. An excellent article appears in our columns to-day, suggesting how these sad accidents may be prevented by the proper employment of electricity.

MR. F. A. CLOUDMAN, of Rondout, N. Y., renews, in a communication to the daily papers, the discussion of the best means of lighting up ocean thoroughfares. He has also filed with the Treasury Department at Washington plans and specifications for the establishment of a system of life-saving, light-house and telegraph stations across the Atlantic. The vessels, ten in number, would be 200 miles apart, swinging at mushroom anchor, connected with each other and the shore by cable and lighted by electricity. As we have said before, these schemes are good, and the questions involved should be studied out by the governments interested.

THE six-penny telegrams lately introduced throughout Great Britain are not all that the fancy of the public painted. It was supposed that the expense of telegraphing would be considerably reduced, but the rule that the address is included in the twelve words allowed puts quite a different aspect upon the question. The long addresses frequently required in large English towns leave very little for the message itself, and much complaint is heard on al sides on that score. Again, the heavy charge for delivery beyond one mile from the telegraph office makes the *six penny* telegram decidedly expensive. Still the fact remains that the business has been largely increased since the new regulations went into operation. Considering these things abroad we ought not to complain of the present competitive rates at home, provided the service were as good as it ought to be, which unfortunately it is not—quite.

THE trial of Ferdinand Ward, of the firm of Grant & Ward, is now going on, and its progress is watched with universal interest. The object of the evidence now presented is to show that Ward obtained a certified check for $71,800 by false pretenses, and practically stole the money. In support of the charge, ex-President Fish, of the collapsed Marine Bank, and now in prison, testifies that he had a conversation with Ward over the telephone in regard to the check, when Ward assured him that there were funds to cover the amount on it. This statement is supported by Benjamin Fish, brother of James D. Fish, he swearing that at a distance of two or three feet from the instrument he heard both sides of the conversation. Counsel for the defense has already raised the point that the conversation is not competent evidence, the court ruling that the witness could tell what he said. Counsel may offer the further objection that the replies dluocnot be heard two or three feet from an ordinary instrument. Here will be the chance for experts.

OUR recent comment on the course in electrical engineering at Cornell University has brought out a letter from a correspondent, which we give in another column. We are glad to know that the suggestions we made for improving the course at Cornell are already in operation, our knowledge regarding the course having been limited to the general curriculum sent us. In a pleasant communication to us on this subject, Prof. Thurston says that our "suggestions had already been anticipated," and that the scheme had further been enlarged by the introduction of a special post-graduate course. Our recent comment on the course was not intended as a criticism. While pointing out improvements which might, and, as events show, have been made, we intended primarily to bring out the fact that Cornell is the first of our *universities* to devote herself deliberately to the study of electrical engineering. It must not be forgotten that excellent opportunities are afforded at other schools, such as the Stevens Institute of Technology and the Massachusetts Institute of Technology; but Cornell is, we believe, the first *university* to designate a distinct course of electrical engineering.

THE activity and push of our inventors cannot be better demonstrated than by giving the statement showing the operations of the Patent Office during the fiscal year ended June 30, 1885, prepared by Commissioner Montgomery. This shows that the number of applications for patents received was 32,662; for designs, 1,071; for reissues of patents, 156; for trade-marks, 1,126, and for labels, 673, making a total of 35,688, against 38,832 during the preceding year. The number of caveats filed was 2,515. The number of patents granted, including reissues, was 22,928; of trade-marks registered, 1,092, and of labels, 337, making a total issue of 24,357. The receipts of the office from all sources were $1,074,974, as against $1,145,433 during the preceding year, while the expenditures were $934,123, leaving a surplus of $140,851. Here again we see that the inventors of the country are taxed about $4 per application for no purpose whatever. The money has for years been accumulating in the United States Treasury until now it amounts to over $2,000,000. At the same time the work of the Patent Office is lagging for the want of an adequate force of examiners, and inventors are subjected to long delays. Congress ought to devise some remedy for this state of affairs, and thus put a stop to a crying evil.

A COMPARISON of the meetings of the British and the American Associations for the Advancement of Science shows that at the former the number of papers on electrical subjects was far greater than at the latter. This seems strange in view of the great development which the study of electricity has experienced in our country. We may look for a reason in the fact that so few of our eminent electricians are members of the American Association, and hence this dearth of electrical papers. But even the meetings of the Society to which most, if not all, of them belong, are never overloaded with papers. We refer to the American Institute of Electrical Engineers, at whose past meetings the papers, though interesting, have been limited as compared with the list of members. Constituted as the Institute is, for the most part, of practical men full of experience, it seems strange that this should be the case; yet such is the fact. It has been argued that members have no time to prepare papers; but this is a poor excuse at best, and can be easily refuted. By their neglect in this respect, our electricians lay themselves open to the charge of selfishness in keeping to themselves information which is valuable to all, and the imparting of which is, so to speak, a duty which all true workers should observe, and without which every man's knowledge would be restricted to his own experiences. We hope that our appeal will not go unheeded, and that the next meeting of the American Institute of Electrical Engineers will be well up in the number of papers, upon the preparation of which it is never too early to enter.

ONE of our transatlantic contemporaries draws attention to the fact that no dynamos have yet been made to meet the requirements of city lighting. "They will," it says, "undoubtedly come some day, and the magnificent machines now running at the Inventions Exhibition mark a step on the way; but a machine to supply 10,000 lights is yet a shadow in the future, and this is certainly a very modest little article in the face of the demand for light in large city districts." There is undoubtedly some truth in the above statement, but the construction of very large machines does not seem to have met with corresponding success, not on account of any inherent drawbacks in the machines themselves, but from other causes. Among the latter, the principal one consists in the fact that very large installations, above 10,000 lamps and over, are as yet very rare, and although now beyond the experimental stage, were started as experiments, from the very nature of the problem. Indeed, we know of only one electric light central station distributing more than 10,000 incandescent lamps, and that one is the Edison station in this city. It would have been folly to construc a single machine for this work, for obvious reasons. The fact remains, however, that large machines show greater economy than small ones, and that larger machines will be built; but, while fast approaching, that time has not yet arrived. When electric light central stations shall operate hundreds of thousands of lamps, as gasometers now feed burners in large cities, we may be sure that large machines will be employed. Until that time arrives, their use must be restricted.

IN another column Lieut. Bradley A. Fiske demonstrates neatly the law that an electric apparatus introduced into a circuit will perform its maximum work when its resistance equals that of the rest of the circuit. Ohm as early as 1826 showed that the resistance of a galvanometer should equal that of the rest of the circuit in which it was placed to obtain the maximum effect, and numerous other examples besides those cited in the article might be given. When we come to employ this law practically, however, we find cases in which it cannot be strictly applied. Thus the best resistance of telegraphic electro-magnets for relays, etc., has been an oft-discussed question. Theory would have it that the relay resistance should equal that of the remaining circuit, but in practice it has generally been found that the best results are obtained with less resistance. If sufficient time were given for each electrical impulse to attain its full effect—in other words, if there were no retardation—the law would hold true. But evidently such is not the condition of affairs, as the electrostatic and electro-magnetic induction of telegraph lines and the self-induction of the electro-magnet are important factors which must not be neglected. This is particularly noticed in long lines with high-speed automatic instruments. As was shown recently, much of the retarding effects of the line can be obviated and consequent higher speed obtained by using copper instead of iron, as the factor of electro-magnetic induction then becomes reduced, and then only the self-induction of the coil remains. This evidently is diminished by increasing the diameter and reducing the number of turns upon the receiving instrument, or, in other words, reducing its resistance. The law as stated is none the less true, but as shown requires in some cases the consideration of certain disturbing factors.

Electro-Metallurgy of Copper.*

In a recent article we devoted some space to a consideration of electro-metallurgy in its application to copper, and described the varying influences exerted by different metallic impurities existing in the copper being treated. Besides those referred to in that article, some others remain to be noticed.

Metallic antimony behaves in general like tin. It goes, in acid or in neutral electrolyte, partly into solution, from which it is precipitated as basic salt on standing, and partly it remains as basic sulphate on the anode. The same is true, as in the case of tin, as regards the increase of the basic deposit in weight on exposure to the air. Antimony, therefore, makes the liquor poorer in copper. Antimoniates are not attacked by the current, and are transferred first of all direct into the mud; but by secondary action of the liquor they are decomposed, with separation of antimonic acid, thus giving rise to a neutralization of the liquor.

Even when there is considerable antimony in solution, and when basic salt is being deposited, this metal does not go into the deposit on the cathode, so long as the liquor is kept even approximately right in composition; at the utmost a little basic salt is deposited mechanically on the cathode. This basic salt deposits by preference at those points where the liquor changes in composition—where it grows more dilute—as it does around the cathodes. Antimony may be deposited with the copper if the liquor gets neutral or nearly so; and in case the liquor gets too poor in copper even the proper amount of free acid will not suffice to prevent deposit of antimony.

Lead is attacked by the current before the copper, and goes almost entirely as insoluable sulphate into the mud. Only traces remain in solution, and none is deposited on the cathode. Thus the only effect of lead in the anodes is to make the liquor poorer in copper.

Iron, zinc, nickel and cobalt are dissolved by the current before the copper, and thus cause the liquor to become poorer in copper. There is also, with the low currents used, a distinct amount of secondary action, purely chemical in nature, by which the liquor of the bath dissolves more of these metals than corresponds to the copper deposited on the cathode, so that in this manner the liquor becomes to some extent neutralized and richer in dissolved metals.

Metallic iron, under the conditions as to current etc., which obtain in copper-refining, is always dissolved as protosalt, and only by secondary action, under the influence of the air during circulation of the liquor, is any higher oxidation produced and sesqui-salts formed. Salts of the higher oxide are only produced direct at the anode during the use of currents of such intensity as are never even approximately used in copper refining, about 1,300 $\frac{\text{ampères}}{\text{square metres}}$, and in these cases a liberation of oxygen and free acid is also noticeable.

Concerning sulphide of iron, it was stated by an Italian writer on the subject, Badia, that all sulphides of iron at the anode give rise to the higher oxide of iron in solution. Dr. Kiliani considered that this statement would only be good as regards sulphides of a higher degree of sulphurization than the proto-sulphide FeS, such, for instance, as Fe_2S_3, which occurs in copper pyrites. But a series of very careful experiments made by him, with a current of 20 $\frac{\text{amperes}}{\text{square metres}}$ and a neutral liquor, with total exclusion of air, proved that Badia is right, as the higher oxide was always formed even when the lower sulphide was used at the anode.

All the various reactions named are going on, in practice, more or less at the same time, according to the constitution of the anodes. The mud, after drying, may consist of gold, platinum, silver (silver sulphide), cuprous oxide, copper sulphides, basic sulphates of bismuth, tin and antimony, various arseniates and antimoniates, sulphate of lead, and any slaggy materials which were entangled in the copper of the anodes. There is also present a little metallic copper in the form of powder.

The solution of the anodes does not take place in such a manner that the inner portions are only attacked after the outer portions are dissolved away. The action extends far into the interior of the anode plates, while there is still a large amount of undissolved copper at the surface. Anodes cast direct from the fusion of copper pyrites, after a few days' electrolysis always show a considerable swelling out towards the cathode. The liquor grows constantly richer in metals—iron (zinc, nickel, cobalt, manganese), tin, arsenic, antimony, bismuth, and poorer in copper and free acid.

As concerns the decrease of the copper in solution, this is to some extent compensated by the secondary action of the liquor at the anodes; and, indeed, in cases where purer coppers are being refined, it sometimes occurs that the liquor grows constantly richer in copper instead of poorer, to a degree which cannot be explained by the evaporation of the bath. This is caused by the well-known solvent action of acid copper-sulphate liquor on metallic copper. Cuprous sulphate is formed, which is oxidized by the air to cupric sulphate. In this manner more or less copper is always being dissolved from the anodes, all the more the lower the intensity of the current and the more complete is the circulation and therefore oxidation of the liquor. Any ferric sulphate in the liquor promotes this solvent action. Anode plates are sometimes thus corroded right through at the surface of the liquor.

This action explains the fact that the loss of weight at the anodes, and the gain of weight at the cathodes, are respectively greater and less than they should be, according to the strength of the current used. In experiments that have been made, differences of this nature have been found amounting to 3½ per cent. at the anodes and 2 per cent. at the cathodes. Of course, this action tends to steadily reduce the amount of free acid in the liquor. The gradual neutralization of the bath which is brought about by the above various causes, is very detrimental to the proper conduct of the process. The conductivity of the liquid is diminished. The impurities are more easily deposited with the copper, and also, quite apart from the question of impurities, the deposit is obtained in a very bad state, devoid of the desired toughness. This is caused by an admixture of cuprous oxide, which cannot take place in a sufficiently acid liquor. This cuprous oxide can be seen by the peculiar red color it gives to the deposited copper. Using the normal current of 20 $\frac{\text{ampères}}{\text{square metres}}$, distinctly formed little crystals of cuprous oxide have been obtained. Other experimenters have previously noticed and recorded this deposit of cuprous oxide from neutral liquors. It is therefore of the utmost importance in refining copper that the amount of free acid in the bath be kept at the proper limit, and repeated tests must be made so that the acid may be added as required.

Also, as regards diminution of the copper in solution, this should never be allowed to go too far. Copper sulphate should be added to the bath to keep it near the normal standard for copper. When a liquor is getting too impure, by the gradual solution of the various metals, the copper contained in it can always be obtained as copper sulphate crystals, pure enough for use to add to a fresh lot of liquor.

A condition quite as important for the success of the process as the current, is the proper circulation of the liquor. It is a matter of experience that in the absence of circulation the liquor grows richer at the anodes and poorer at the cathodes, and that the poorer liquor rises at the cathodes and collects at the top of the bath. In this manner not only does a layer of liquor of greater resistance get formed in the way of the current, but it may occur that when the copper in solution is much reduced the current may be partly employed in decomposing some of the other constituents of the bath, with separation of other metals besides copper, or the free acid may be decomposed and hydrogen gas liberated. The effect of circulation of the liquor makes itself principally felt in the difference of the potential of the bath.

But in addition to the increase in difference of potential, bad circulation seriously affects the nature of the deposit of copper, which is always purer and tougher, the better the circulation, even in perfectly pure liquors, and when all other favorable conditions are properly observed.

As concerns the amount of work which has to be done in order to deposit a given amount of copper on the cathode, it is clear that only the resistance in the circuit has to be overcome, and that no work has to be reckoned for the decomposition pure and simple of the copper sulphate, because exactly as much energy as is consumed at the cathode is liberated again at the anode. Indeed, theoretically, the energy set free at the anodes should exceed that consumed at the cathodes, as in place of some of the deposited copper, the current causes the solution at the anodes of some of the more electro-positive metals whose "heats of oxidation" are greater than that of copper sulphate.

But if we compare the difference of potential of a bath in which both electrodes are of pure copper with the difference of potential of other baths in which the copper of the anodes is alloyed with one or other of the electro-positive impurities occurring in black copper, all other conditions being kept alike, we shall only find the lowering of the difference of potential to be really noticeable when the impurity amounts to a considerable percentage of the copper. And even in these cases, or most of them, we shall find that such primary reduction of the difference of potential will be very rapidly replaced, as it always is with impure black coppers, by a secondary action due to "polarization," which restores the difference of potential to its original value, or even increases it.

This "polarization" is explained in the case of copper by the fact that local currents are set up between the anodes and the mud adhering to them, the direction of which currents is contrary to that of the main current. Further, the anodes are covered more or less with badly-conducting oxides or sulphur; differences of concentration of the liquor occur at the surfaces of the electrodes; and as soon as the impurities are once in solution, their salts are more or less acted upon at the cathodes. Although this latter action is but slight, and the separated metals are redissolved by secondary action, still it is quite enough to have a very decided effect on the difference of potential. In addition to all this, it is only too easy to have also a slight liberation of hydrogen taking place in the bath, and even when this is so minute as to entirely escape the observation of the operator, it seriously affects the difference of potential.

The increase in difference of potential, conditions of circulation, etc., being normal, is in general proportional to the amount of impurities contained in the anodes and in the liquors. For instance, if we have an observed difference of potential of 0.095 volt in a bath using electrodes of pure copper 5 cm. apart, and if we then remove the anode and replace it by one of black copper, we shall find that the bath then shows a difference of potential of 0.12 volt. (The black copper in question contains 0.403 per cent. silver, 0.011 per cent. gold—1.23 per cent. arsenic—1 per cent. iron, 0.54 per cent. sulphur.)

Again, if we have both the electrodes of pure copper and replace the liquor by one which contains only 2 grammes of copper per litre, the remainder of the normal copper-strength being substituted by iron, we get a difference of potential of 0.22 volt, which rises to 0.25 volt if we replace the anode again by one of black copper, and to 0.5 volt if we replace it by one of copper pyrites. If the liquor is allowed to become neutral in addition to the above change in composition, the difference of potential for anodes of black copper and copper pyrites amounts to 0.35 volt and 0.75 volt respectively.

In general, the difference of potential of the baths rises, on the introduction of new anodes, gradually to a maximum from which it falls instantly, though but slightly, if the mud is brushed off the surface of the anode.

The difference of potential in the baths is the main factor which has to be taken into account if we desire to calculate the amount of copper we can produce from a given material with a given consumption of power. All we require to do is to make a trial on a small scale with the same strength of current that we consider best suited to the regular work, and with the same distance between the electrodes, and to measure the difference of potential between them, which is best done by means of the torsion galvanometer of Siemens and Halske. The tension at the binding screws of the dynamo machines, divided by the tension thus ascertained in the bath, gives us the maximum number of baths which we could theoretically use in series. Thus, suppose that the tension at the binding screws is 15 volts, and that of the bath is 0.25 volt; then, if we neglect entirely the resistance of the conductors outside the actual bath, we could have a maximum of 60 baths in series. In actual practice the number would be really about 40, on an average. If the machine, with the above difference of potential at the binding screws, gives a current of 240 ampères (machines C_{18} of Siemens and Halske), then, as each ampère is equal to 1.1817 gramme of deposited copper per hour, the whole current is equal to 283.61 grammes of deposited copper per hour, and 40 baths in series are equal to 11.344 kilos of copper per hour, or 272.26 kilos per 24 hours.

The amount of power required for such a production is calculated according to a formula by which the strength of current in ampères is multiplied by the difference of potential at the machine in volts, and the resulting figure divided by 736. Thus in the above case $\frac{240 \times 15}{736} = 4.89$ horse-power (French) at the dynamo where, however, in actual practice, the loss in transmission, etc., must be taken at 6 horse-power.

If we divide the figure expressing the strength of current by the figure obtained from the "normal" formula, 20 $\frac{\text{ampères}}{\text{square metres}}$, we get the amount of electrode-surface for each bath: and if we take as a datum that each anode must be 5 centimetres distant from the next cathode, we can calculate the cubic contents of the baths.

As regards the tension and the strengths of current to be used with a given power, it is theoretically the same thing, so far as concerns the relation of the power to the amount of copper deposited, whether we have a machine with, say, 30 volts tension at the poles and a current of 120 ampères, or one with 15 volts and 240 ampères, so long as the strength of the current per given electrode surface remains the same. In practice, however, there is this important difference, that with low tensions the conductor must be exceedingly thick and as short as possible, so that the machine must be placed close to the baths, and any increase of resistance in the baths causes much more serious derangement of the work than is the case with higher tensions.

The first plant used at Oker, in Germany, consisted of a machine giving 3½ volts and 1,000 ampères, and it is stated that the copper conductors had to be as thick as "a child's arm," and even then got perceptibly heated. Such conductors also caused great increase in the cost of the plant. The machines now used at Oker give 15 volts and 240 ampères, or 30 volts and 120 ampères. The material for the cathode plates should always be the purest electrolytic copper, as experience has always proved that the best deposits are obtained upon it. The length and thickness of conductors are regulated by the conditions of current used. The above-mentioned machine (C_1) of Siemens and Halske, giving 3½ volts and 1,000 ampères, required a conductor of 25 square centimetres section, and had to be placed close to the baths, whereas the machine C_{18}, with a conductor of 12 millimetres thickness, may be 40 to 50 metres distant from the baths.

The greatest care must be taken to constantly determine the conditions of the current, and it is strongly advised not to allow the "mud" to remain too long in the baths,

* *Engineering*, Sept. 25, 1885.

as is done at some establishments, because, as before explained, some of the impurities in it are slowly dissolved by the bath. Also the anodes should be taken out periodically and cleaned of mud on the surface, but care must be used that no particles of this are allowed to fall into the bath, as any such which may adhere to the cathode cause bad places on the deposited copper.

The final remarks of Dr. Kiliani, whose investigations we have been following, deal with the economic side of the question. He points out that the great drawbacks to this method of refining copper consist in the high cost of the necessary machines and tanks, etc., and in the large amount of space required for the work, as well as the length of time during which the copper remains locked up under the treatment. Thus a plant worked by a machine C_{18} of Siemens and Halske takes up a space of 80 square metres, and with the normal current indicated in the foregoing descriptions, it requires five months to deposit a piece of copper 1 centimetre thick. The anode of black copper must remain almost as long in the bath, for the same thickness. Of course the interest on all the copper thus locked up, plays an important part in the calculations for and against this process as compared with the older ones.

But Dr. Kiliani considers that in spite of its drawbacks the process deserves preference where copper containing precious metals has to be dealt with. And though in its present form it may not be entirely a brilliant affair, still it is predicted that the electro-metallurgy of the copper will eventually not be limited to working on the black copper which has been obtained by smelting the ores by usual methods, but will be able to deal direct with the ores themselves.

Static Electricity.

BY PHILIP ATKINSON, A. M., PH. D.

CHAPTER VI.

ACCUMULATORS.

THE CHARGED PANE.—The electric charge which may be condensed on the surface of an insulated conductor is com-

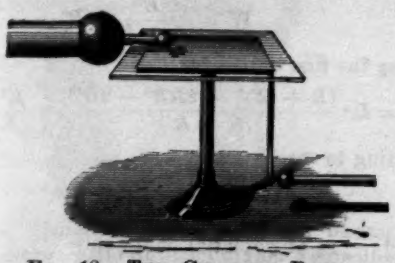


FIG. 18.—THE CHARGED PANE.

paratively small, when such a conductor is remote from inductive influence. But, when another conductor, having a connection with the earth, is placed in its immediate vicinity, the charge may be greatly increased.

To prove this, let a sheet of good insulating glass,

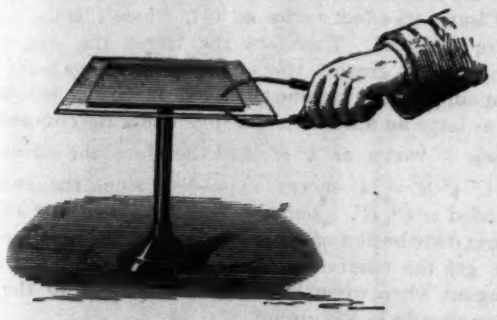


FIG. 19.—THE PANE DISCHARGED.

varnished with shellac, be coated on opposite sides with tinfoil, to within about two inches of its edge, and placed on an insulating support, as shown in Fig. 18. A small charge can be given to the tinfoil, on the upper surface, which will be indicated by sparks passing between it and the body from which the charge is given. But the limit is soon reached, and no more sparks will pass.

Now let the lower surface be connected with the earth by a strip of tinfoil, and sparks will again pass freely between the charging body and the upper surface, till a charge greatly in excess of the former is given.

If the tinfoil strip be suspended with its lower end near a conductor, as shown, sparks will pass between it and the conductor, simultaneous with the sparks on the upper surface; indicating that each surface receives the same amount of charge.

But the potential on opposite surfaces will be opposite. If the upper surface acquires positive potential by an increase of electricity, the same amount will be repelled from the lower surface, making it negative. But if the upper becomes negative by a decrease, electricity, to the same amount, will be attracted to the lower surface, making it positive.

To prove that these charges are equal, let the tinfoil strip be removed after the plate has been charged; and a wire, held by a piece of india-rubber tube, to insulate it, be bent so that its ends come into contact with the opposite surfaces, as shown in Fig. 19; a flash and report will follow, and both surfaces, after the wire has remained in contact for a few moments, will be found completely discharged.

Now, since the removal of the strip produced complete insulation, perfect equilibrium could occur only by the positive of one surface being exactly equal to the negative of the other.

Since induction varies inversely as the square of this distance (ELECTRICAL WORLD., vol. vi., No. 3, page 24), it is evident that if this factor alone is considered the amount of charge which can be given will be in the inverse ratio of the thickness of the glass, and hence greater on thin than on thick glass. But since the resistance of glass is in the direct ratio of its thickness,

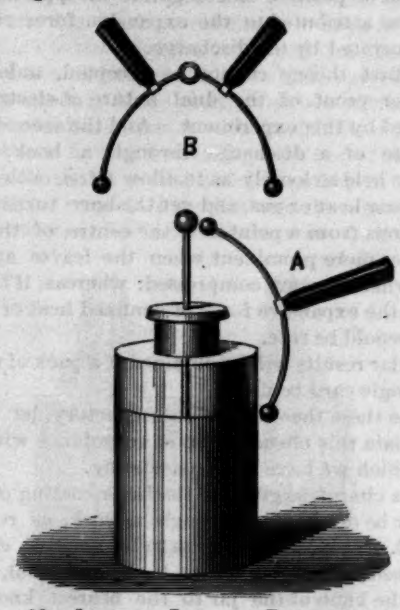


FIG. 20.—LEYDEN JAR AND DISCHARGER.

when the specific inductive capacity is the same, this factor must also be considered.

Hence, in the construction of instruments involving these principles, if great sensitiveness and a low potential is desired, the glass, or other dielectric, should be thin. But if the highest attainable potential is desired, there should be sufficient thickness to resist fracture or puncture.

The uncoated margin must also be wide enough to make the resistance there equal to that of the thickness; a small fraction of an inch in thickness having a resistance equal to that of several inches of surface.

No definite rules can be given, as the resistance of various kinds of glass, and other dielectrics, varies greatly, as well as the cases in which they may be required.

As the positive and negative on opposite surfaces are equal, it is impossible for a change of potential to occur on either surface without a corresponding change on the opposite surface. Hence a conductor brought into contact with either surface alone will not change its potential unless directly or indirectly connected with the opposite surface. Hence the charge on each surface is said to be *bound* by the opposite charge.

The convection and conduction of the air, so far as it can act equally on both surfaces, will in time restore equilibrium. It may also be restored by the oscillation of a solid body, as a pith ball suspended between conductors

FIG. 23.—DISCHARGE THROUGH A BOOK.

connected with both surfaces; or, by direct connection through a conductor, as already explained.

Instruments constructed for accumulating electricity in this way are called *accumulators* or *condensers*.

THE LEYDEN JAR.—The first discovery of an accumulator was made by Kleist, a clergyman of Cammin, in Pommerania, who stated in a letter to Dr. Lieberkühn, of Berlin, Nov. 4, 1745, that by pouring a little mercury, "spirits," or water, into a phial and connecting it with a nail through the cork, he could electrify it through the nail, ignite "spirits of wine" with it, and receive a shock by touching the nail with his finger.

The same discovery was made in the following year in Leyden, by Cuneus, a pupil of Musschenbroek, who electrified some water in a flask, which he held in his hand, by bringing it into contact with a chain from the conductor of an electric machine. On attempting to remove the chain with his other hand, he received an electric shock which so frightened him that he dropped the flask. Musschenbroek, having tried the experiment, said he would not take a second shock for the crown of France.

The discovery created great excitement, and led to the construction of improved instruments, to which the name "Leyden jar" was given.

The water in this instance constituted the inside coating, the hand the outside coating; and, when the other hand touched the chain, both surfaces were connected by a conductor, and a discharge followed, which produced the shock.

Fig. 20 represents the Leyden jar as it is usually constructed. The essential elements are two conducting surfaces separated by a dielectric; but, for convenience in charging and discharging, a wooden cap is fitted to it, through which passes a brass rod, terminating in a ball above; and to its lower end is attached a light spring, or a chain, which comes into contact with the inside coating.

Tinfoil is the usual coating, and is put on with paste, covering both surfaces equally to within about three inches of the top. Light sheet brass makes a more substantial outside coating, and does not require attachment to the surface. It can also be used for the inside coating, when the mouth is the full width of the jar and the sides are straight.

Sulphuric acid is also sometimes used for the inside coating of jars designed for special purposes.

An instrument called a *discharger* is also represented at *A*, in Fig. 20. It consists of a curved brass rod terminating in balls, and having an insulating handle, of ebonite or glass, attached to its centre. It is sometimes jointed at the centre, and furnished with two handles, as represented at *B* in Fig. 20.

Its use is the same as that of the bent wire already described.

The Leyden jar can be made of any insulating material capable of being molded into the proper form; but glass seems to be the only substance capable of resisting the

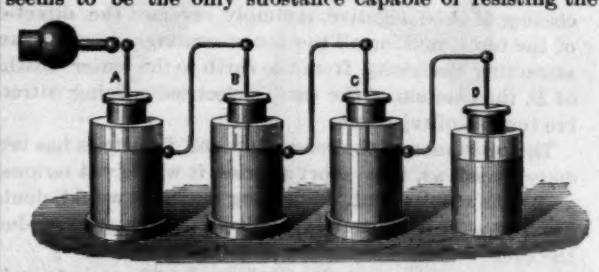


FIG. 21.—JARS IN CASCADE.

enormous strain to which the dielectric is subjected under a full charge.

Glass suitable for the purpose must be free from any

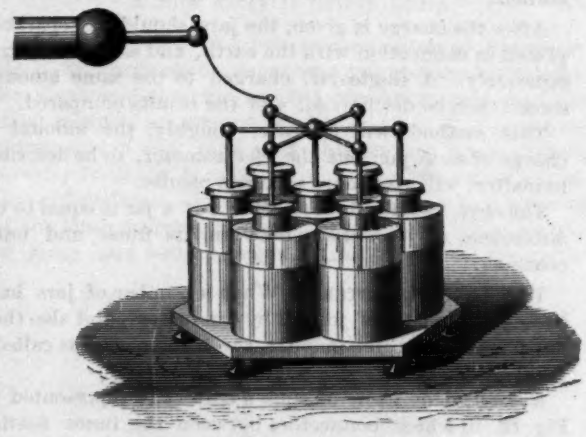


FIG. 22.—LEYDEN BATTERY.

substance which makes it a partial conductor. Hence such glass as is commonly used for fruit jars, candy jars and druggists' bottles cannot be used, since it contains metallic substances.

Glass of a bright green color, free from bluish tint, also the kind known as "hard flint," makes the best Leyden jars.

The Leyden jar is charged by an electric machine, its inner coating being connected with the machine, and the outer coating with the earth, or with the opposite electrode of the machine.

It is not material which coating is connected with the machine, except as a matter of convenience.

The jar may be insulated, and the charge given to the outer coating, if the inner coating is connected with the earth.

It is also immaterial whether the charge given is positive or negative, as the opposite charge will always be induced on the opposite surface, electricity being repelled to the earth when a positive charge is given, or attracted from the earth when negative is given.

CHARGE BY CASCADE.—The method of charge by cascade, first proposed by Franklin, is as follows: Let a number of jars of equal size, as *A*, *B*, *C*, *D*, be arranged as represented in Fig. 21; the outer coating of each, commencing with *A*, being connected with the inner coating of the one next to it; *D* having its outer coating connected with the earth, and *A* having its inner coating connected with the machine. And let *A*, *B* and *C* be well insulated on cakes of paraffine or some equally good insulator.

A positive charge given to the inner coating of *A* will

induce negative on its outer coating by repelling the same amount of electricity, and this repelled charge must go to the inside of *B*, since it has no other outlet. Hence the inner coating of *B* will be positively charged to the same amount as that of *A*, and the same amount will, in like manner, be repelled from its outer coating to the inner of *C*. Hence each jar in the series will be charged the same as *A* and to the same amount, the charge from the outer coating of *D* being repelled to the earth.

The amount of electric energy *expended* will be no greater than if *A* alone had been charged, with its outer coating in connection with the earth, but the amount *accumulated* will be four times as much.

Yet there is no actual increase of electricity, but simply a transfer from the outer to the inner coatings, while that added to the inner coating of *A*, to make it positive, is exactly counterbalanced by that repelled to the earth from the outer coating of *D* to make it negative.

If each jar were charged separately, four times the energy would have to be expended, as the electricity from each outer coating would be repelled to the earth, instead of being transferred and thus accumulated. And the energy expended in charging each jar would have to encounter the reaction of the earth's electricity against the negative potential of its outer coating, while the energy expended in charging the series encounters this reaction only against the negative potential of the outer coating of *D;* action and reaction being equal between the intermediate jars.

This will be more fully understood if the jars *B*, *C* and *D* have their inner coatings connected with the outer coating of *A*, and their outer coatings with the earth. The charge from the outer coating of *A* would then be divided equally between the three jars, each receiving one-third and sustaining one-third of the reaction from the earth.

If, when they are in series, the charge given to the inner coating of *A* be negative, it simply reverses the direction of the force, making all the inner coatings negative, and attracting electricity from the earth to the outer coating of *D*, the reaction of the earth's electricity being attractive instead of repellant.

The resistance of the conductors and dielectrics has been disregarded, as, in so short a series, it would not seriously affect the results; but, in a long series, it would, doubtless, occasion a greater expenditure of energy to produce the same results.

The insulations and connections should receive careful attention, so as to prevent loss by leakage, which will inevitably occur if the insulation is imperfect, or if the connectors have points, sharp edges, or projecting corners.

After the charge is given, the jars should be separated, placed in connection with the earth, and each discharged separately. A single jar, charged to the same amount, should then be discharged, and the results compared.

This method will indicate, roughly, the amount of charge of each jar; but the electrometer, to be described hereafter, will give more accurate results.

The *electromotive force* (E. M. F.) of a jar is equal to the difference of potential between its inner and outer coatings.

THE LEYDEN BATTERY.—When a number of jars have their inner coatings joined by conductors, and also their outer coatings in like manner, the combination is called a Leyden battery.

A convenient form of such a battery is represented by Fig. 22, in which connectors between the inner coating radiate from a central jar. The outer coatings are made of sheet brass, nickel-plated, and screwed to a wooden base, their connections being made with copper wires attached to the points of the screws underneath.

This construction for the outer coatings, which was devised by the writer, makes them durable, gives the jars a firm attachment, and adds greatly to the neatness and beauty of the instrument.

The E. M. F. of a Leyden battery is the same as that of a single jar having the same amount of coated surface. There can be no increase of intensity from any special arrangement of the jars, as such a battery is merely an *accumulator*, and not a *generator* of electricity.

But when great E. M. F. is required, it is generally more convenient to use a battery than a single jar of equal energy. And, in case of fracture from an over-charge, a small jar can be replaced at less expense than a larger one.

In charging or discharging a battery, it is immaterial which jar is selected, for all the inner coatings being connected together, as well as all the outer coatings, each is practically the same as a single coating of equal size, and connection with any part of either coating affects the whole of that coating.

DISCHARGE THROUGH A BOOK.—The discharge from a Leyden jar or battery, passed through a card or a thin book, leaves a puncture, with *a burr projecting from each surface.*

To perform this experiment successfully, let one knob of the discharger be placed in contact with the outer coating, and the other in contact with the book, and let the book, held by its edge with the knob against it, be brought quickly into contact with the knob of the jar, and the discharge will take place as shown in Fig. 23.

In this way a book of 100 or more pages may be perforated.

If the book is first placed in contact with the knob of the jar, part of the charge will escape from the edges and corners of the leaves, and the experiment is liable to fail.

The burr projecting from each surface, after the discharge through a book or card, has been relied on as a proof of the dual nature of electricity, and ascribed to the rush of positive and negative in opposite directions. It is also attributed to the expansive force of heat or of gas generated by the discharge.

The first theory cannot be accepted, unless we have stronger proof of the dual nature of electricity than is afforded by this experiment. And the second fails, as in the case of a discharge through a book, the leaves may be held so loosely as to allow a free outlet for expansion from heat or gas, and yet the burr turns in opposite directions from a point near the centre of the book, and becomes more prominent when the leaves are thus held than when they are compressed; whereas, if the burr were due to the expansive force of confined heat or gas, the reverse would be true.

Similar results will be obtained if a pack of cards instead of a single card be used.

Since these theories are unsatisfactory, let us endeavor to explain this phenomenon in accordance with the principles which we have been considering.

Let a charge be given to the inner coating of a jar, and the jar be discharged through a book, as represented in Fig. 23. Suppose the charge to be positive, electric movement being from higher to lower potential, it would be from the knob of the jar to the nearest knob of the discharger.

The entire charge of the inner coating, passing out through the knob, would induce a high negative potential on that point on the nearest surface of the book, in a line between the knobs, repelling the electricity of the book along that line to the opposite surface, which would thus become highly positive.

The paper being a very imperfect conductor, the charges thus induced do not spread rapidly, but remain concentrated for a moment on small circular spaces around each of these points; the greatest intensity being at the centres. Hence there is a powerful attraction between the knob of the jar and this negative point on the surface of the book; and also between the knob of the discharger and the positive point on the other surface; under the influence of which the paper on each surface gives way and bursts outward toward the knobs; that surface next the knob of the jar being attracted, and that next the knob of the discharger repelled.

As each outward leaf bursts, the next, becoming then the outer one, bursts also, till the perforation is complete from the centre each way. All of which occurs instantaneously.

Meantime the electricity from the knob of the jar follows up this inductive effect on the electricity of the book; but meeting great resistance from the imperfectly conducting paper and the air between the leaves, it is concentrated on each leaf successively, so that the inductive force is constantly in advance of the charge, the leaves and layers of air between them constituting the dielectric.

It will be noticed, then, that this is not a case of energy going through a passive medium, but of *energy acting on the energy of that medium, causing it to become active and perform work.*

It should also be noticed that when the leaves are held loosely, the thickness of the air dielectric is increased; each layer of air having a charged surface of partly conducting paper on each side of it, is in the position of the coated pane, a powerful attraction between the surfaces acting across it. And when the paper bursts there is more room for the formation of a burr, and less resistance to the tearing of the paper, which accounts for the increased prominence of the burr.

If the charge of the jar is negative, the same results occur in reverse order.

(TO BE CONTINUED.)

Underground Wires.

At the last meeting of the Boston Society of Arts, Dr. W. W. Jaques, Ph. D., read a paper on "Recent Progress in Underground Wires," during the course of which he remarked: Years ago the number of wires in use in our American cities was small compared with those in use today. The telephone, whose wires outnumber those used for all other purposes, in most of our cities was entirely unknown. The electric light had not come into practical use, and the number of telegraph wires was far less than that in use at the present day. There were no underground lines in use, and cables were unheard of, except for crossing rivers and streams, and gutta percha, which answers perfectly well for such purposes, was almost the only kind of cable known. The introduction of the telephone and electric light, together with the enormous increase of telegraph communication, has given rise to a great cobweb of wires, extending from the business portions of most of our large cities. These wires have become so numerous as to make it very desirable, both on the part of the companies operating them and on the part of the public, to gather them together into cables and place them underground. The public object to overhead wires, because of their unsightliness, because of their serious hindrance to firemen, and because of the serious annoyance to tenants of buildings, on which the lines may be placed, caused by the linemen tramping up and down the stairs and over the roofs. The companies operating the wires find it very desirable to place them underground, because so large a number of wires are continually crossing one another, thus becoming inoperative, and because every two or three years there comes a heavy sleet storm, followed by wind, which breaks down the wires and crosses them up, so as to interrupt communication. The annual cost of repairs in cities is less than 30 per cent. of the first cost of construction.

The substitution of underground for overhead wires is necessarily slow, because it has economic considerations which make it impossible to at once abandon the expensive plant of overhead wires in favor of a still more expensive plant underground. Sufficient progress has been made with underground wires to prove that the wires once buried are more economical and less liable to interruption than overhead wires. Telegraph wires have been placed underground in most of the European cities for many years, and there is no technical or economical reason why the more important lines of telegraph wires should not be placed underground in American cities. In regard to legislation looking towards the forcing of wires underground, the telephone companies at least are getting their wires together in cables and placing these cables underground as rapidly as possible, as any legislation requiring the immediate placing underground of absolutely all telephone wires would be extremely inexpedient.

A General Law.

BY LIEUT. B. A. FISKE, U. S. NAVY.

Suppose that into any circuit having a resistance R and a constant E. M. F. we introduce a device having a resistance R'. Then the energy expended in this device will be

$$W = \frac{E^2}{(R+R')^2} R'.$$

Taking the first derivative

$$\frac{dW}{dR'} = E^2 \frac{(R+R')^2 - 2RR' - 2R'^2}{(R+R')^4} = \frac{R^2 - R'^2}{(R+R')^4} E^2.$$

Equating to zero

$$R^2 = R'^2$$
$$R = R'.$$

The second derivative being obviously negative, this result indicates a maximum. In other words, the maximum amount of energy can be secured in a device introduced into a circuit by making its resistance equal to the resistance already in the circuit.

Two very well-known consequences follow from this law.

Suppose we wish to put an electro-magnet into a circuit having already a known resistance, and that we desire to get the maximum magnetic effect out of this magnet.

Clearly its effect varies as $C\,l$, where l is the length of wire employed. Therefore the larger the wire and the longer, the greater the effect, other things being equal. But suppose the volume occupied by the coils to be fixed at as large an amount as possible under the circumstances. Then l varies as $\sqrt{R'}$, and therefore the effect varies as $C\sqrt{R'} = \sqrt{\text{energy expended}}$, since the energy expended $= C^2 R'$. Remembering the above law of maximum distribution of energy in a circuit, it follows that we get the maximum magnetic effect from any electro-magnet when we make its resistance equal to the resistance already in the circuit.

The case of an electro-motor is similar if we consider the E. M. F. as a resistance R'. Suppose the resistance of the circuit, including motor, is R; then this law asserts that we will get the maximum effect from the motor when this apparent $R' = R$. Thus,

$$C = \frac{E}{R+R'} = \frac{E-e}{R}$$

When $R' = R$,

$$\frac{E}{2R} = \frac{E-e}{R}$$
$$E = 2E - 2e$$
$$e = \tfrac{1}{2} E$$

In other words, the well-known cases of the magnet and the motor are simply two applications of this general law.

An Alderman on the Telephone.

The following clipping from the Galveston, Texas, *News*, of recent date, taken from a report of the City Council proceedings, shows a rare stand for an Alderman:

The petition of the Southern Telephone Company, asking for right of way to establish another telephone system in the city was read, and a motion by Alderman Goldthwaite to table the same was lost.

Alderman Weis saw no reason for not granting the petition.

Alderman Goldthwaite had traveled around a good deal, and of twenty-five cities in the United States, he knew of none of the like size of Galveston that had a more efficient telephone system that were getting cheaper rates. He had corresponded with a number of cities in Texas using telephone systems, and he found Galveston was getting on very well with her present system. He thought they should be allowed to make money out of their investment without competition.

The Arc System of the American Electric Manufacturing Company.—III.

In concluding in this issue our description of the above excellent system, we bring before our readers a class of lamps which has, perhaps, more than any other taxed the genius of inventors to construct. We refer to the so-called "focusing lamps," in which the object to be attained is the maintenance of the arc in a fixed place, notwithstanding the unequal consumption of the positive and negative carbons. The manner in which this is accomplished in

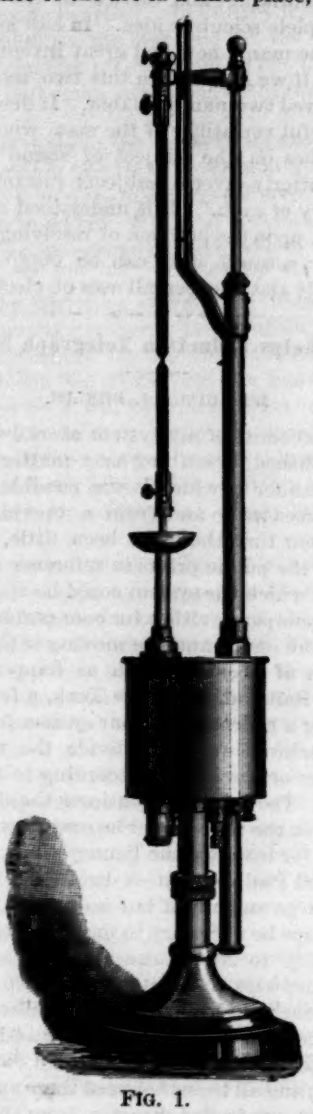


FIG. 1.

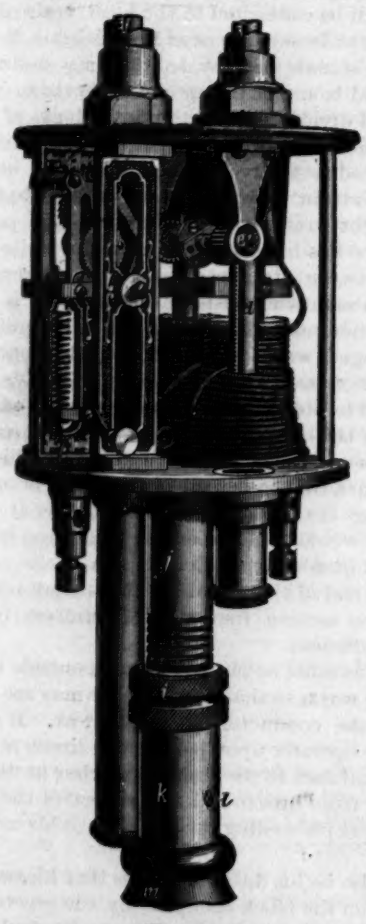
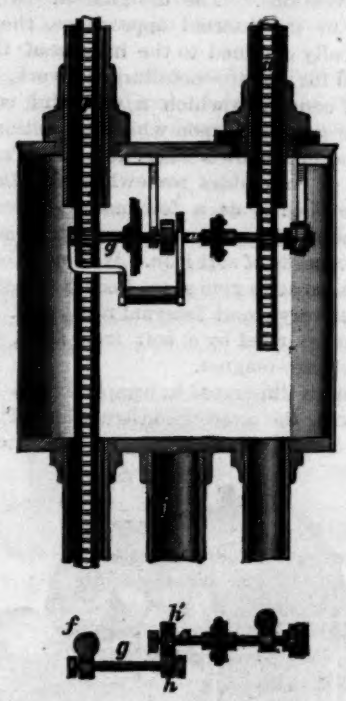


FIG. 2.

the Wood focusing lamp will be understood from the following description:

In the accompanying illustrations, Fig. 1 is an exterior view of the lamp, Fig. 2 showing the interior construction. As will be seen from Figs. 3 and 4, the carbon carriers of the lamp are geared together with positive connections, the pinions and wheels being fastened rigidly to the spindles, but insulated by a coupling consisting of hard rubber disc, shown in Figs. 3 and 4, and enlarged in Fig. 5. It will be seen from the latter that the spindle *a* is cut in the middle, leaving a space of about an eighth of an inch. Each end of the spindle is fitted with a cross-arm *bb'*, which is screwed to a hard rubber disc *c* in such a manner that the cross-arms *bb'* stand at right angles to one another on each side of the disc *c*. The screws pass through the rubber and screw into the arms *bb'*. This arrangement results in a perfect insulation, also leaving the spindle as strong as if it were in one continuous piece; the connections being such that they are not liable to be interfered with by shrinkage or change of temperature.

Figs. 3 and 4 show the position which this spindle occupies in the lamp; *d* represents the negative carbon carrier, which is insulated from the body of the lamp; *e* represents an insulated bearing, in which one end of the spindle *a* revolves; *f* is the positive carbon carrier, and *g* is a spindle which connects it with the spindle *a*; *h h'* are two gear wheels having a relative proportion of two to one The two feed rods are so connected together as to move forward in their respective proportions, the whole being so rigid in its construction that either carbon carrier can be



FIGS. 3 AND 4.

forced in either direction without in any way endangering the operation of the feed mechanism, or injuring the insulation. The direction which the current takes in passing through this lamp is similar to that described in Fig. 2 of Article II. in our last issue. Referring to Figs. 1 and 2, it will be seen that the base of the lamp is so constructed as to provide an adjustment for raising or lowering the whole mechanism of the lamp; in order to always maintain the light in the focus of the reflector, the body of the lamp rests upon the tube *j*, on which the knurled nut *i* turns, this nut being turned to the left to raise, and to the right to lower the lamp. This tube *j* slides into a tube *k*, and is held in position by the screw *l* which fits into a slot in the tube *j*. The nut *i* is held in its position by a screw not shown, the end of which fits into a groove around the tube *k*, which sets up the ornamental base *m*.

We close this description with noticing Mr. Wood's so-called "semi-incandescent" lamp. The interior construction of this is shown in perspective in Fig. 6, and the diagram of the circuits being shown in Fig. 7; the latter also shows the action of the automatic cut-out, which is operated by repulsion. The lamp was designed by Mr. Wood to be used in series with the standard arc lamps, or for separate use where a greater distribution of light is desired, and the volume of light produced by the standard lamp is not required. It is of low resistance—about two ohms—the standard lamp being about four and a half ohms, and produces, of course, a considerably smaller light. About twice as many of these lamps are operated from the same machine as the lamps of standard illuminating power.

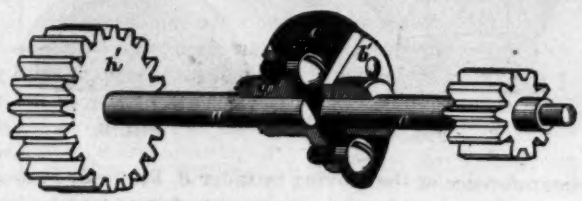


FIG. 5.

Referring to Fig. 7, it will be seen that the current enters at the upper left-hand corner at the wire marked +, following the direction of the arrows down the rod *a* to the positive carbon, thence to the negative carbon, and back through the magnets *bb'*, which are in the main circuit, and thence out through the wire marked — to the generator, or to the next lamp in series. The current divides itself between the resistance of the arc and the resistance of the shunt magnet coils *cc*. These coils are wound in a direction so as to set up a polarity in the cores similar to that of the current flowing through the magnets *bb'*. The action is as follows: Imagine the carbons in contact, and the current from any source sent through the lamp; after passing through the carbons it will pass through the solenoid coils *bb'*, which are in the main circuit, causing them to attract the shunt magnet *c*, which is of horse-shoe form, and acts as an armature for the main solenoids *bb'*. This action produces the separation. As the carbons are consumed a greater proportion of the current will be diverted through the shunt magnet coils *cc*, in a direction tending to neutralize the magnetic influence of the solenoids *bb'*, allowing the magnet *c* to gravitate downward, to produce the feed of the carbons. In case the carbons should fail to feed and the arc become abnormally long, a still greater proportion of current will be diverted through the shunt magnet coils *cc*, which will polarize the cores similar to the polarity of the current flowing through the solenoids *bb'*, and cause them to repel or force out the magnet armature *c'*. If the lamp then fails to feed, they will continue to force out the armature, which will come in contact with the lever *d*, tripping it and allowing the contact points *e* to be automatically closed, switching the light out of circuit. When it is desired to switch the light out by hand, all that is required is

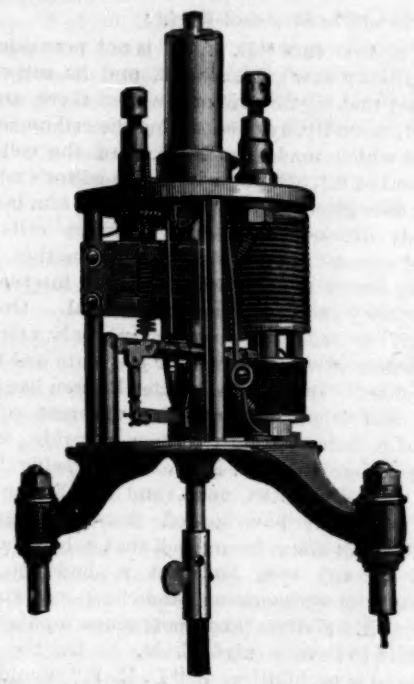


FIG. 6.

to move the hand switch *f* so that it will close contact with the knob *g*. The reverse operation will again reëstablish the arc. The precise arrangement of the several parts in this lamp is shown in Fig. 6.

A New Electric Safety Lamp.

At the meeting of the British Association at Aberdeen, Mr. J. W. Swan read a paper on a safety lamp for miners Mr. Swan said that his safety lamp for miners was the latest result of an attempt to adapt electric light to the requirements of coal mining, having for its object greater security from the danger of the lamp causing an explosion of fire-damp. He exhibited the lamp, which consists of the lamp proper and a secondary battery. The weight of lamp and battery together is 6¾ pounds, the cylindrical case containing the cells measuring 8 by 4 inches. The light given for twelve hours' use is equal to half a standard candle, but by reducing the time of lighting to eight hours, the current may be increased, and a light obtained equivalent to three-fourths of a standard candle. A single charge provides for a whole day. Mr. Swan held that the appellation of "safety" could be given to this lamp without any reservation. Whatever its faults—and he was not so partial a judge as to be incapable of seeing them—this electric lamp possessed at least the capital merit of being absolutely safe; free, he believed, from even the suspicion of a possibility of causing an explosion of fire-damp. If it was neither so light nor so

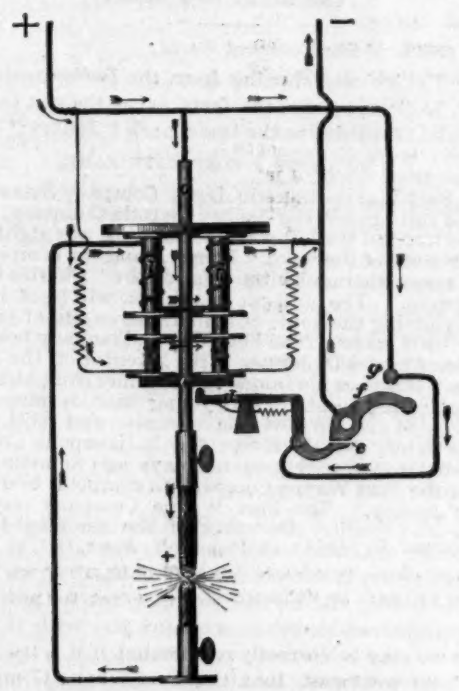


FIG. 7.

cheap as the ordinary lamp, it was in both respects at least practicable, and especially was it to be noted that the working cost would probably not be more than that of the ordinary lamps. As regarded weight, he was not without hope of being able to reduce it, but he would rather have more light to the same weight than a less weight with a less light. It required no air; and there were unfortunately times after an explosion of fire-damp when the air of a pit is so foul that no oil lamp will burn in it. With a Fleuss apparatus for breathing, and the electric safety lamp, the work of exploration, which could hardly be otherwise accomplished, might be carried on, and this, it was reasonable to hope, would be attended with the saving of life.

"A New Galvanic Cell."

To the Editor of The Electrical World:

SIR: I observe that "D. H. F." is not persuaded that I have described a new galvanic cell, and he surprises me, first, by not making distinctions where there are differences; and, secondly, by condemning the cell on account of a misprint which made the E. M. F. of the cell only 1.1 volts instead of 2.1, although both the editor's notice and the other data given would have informed him better.

The only differences between different cells consist in the employment of one substance for another, and the chief thing aimed at is high E. M. F., low internal resistance, constancy and cheapness of material. One might just as well say that the Bunsen cell was only a Grove cell, because carbon was substituted for platinum and the reactions are alike. But, in reality, the Bunsen has a higher E. M. F., and is properly called a different cell. The Electropoion battery, with sodium chloride, is indeed an old cell, but its E. M. F., instead of being "2 volts or more," is only 1.88 volts, and the Fuller cell has but 1.81 volts. I have tested them over and over again. I did not claim for my cell that it had the highest E. M. F. of any cell, but that it had the highest of any I knew of with common and cheap material, and I think so still. Sodium and potassium amalgam cells are both said to have a nigh E. M. F., but the price of such material is prohibitive. If "D. H. F." should succeed in making a cell with an E. M. F. of 2.5 volts with materials that had been used for battery purposes before, but had not been combined in such a way as to obtain such a result, I for one should think him fairly entitled to speak of it as a new cell, for no one, so far as I know, has reached that figure with common materials. Such a cell would be as far beyond mine as mine is beyond any other I know. There is one other point that needs noticing. The Electropoion battery and the Fuller battery, will quickly run down if put on short-circuit, while I distinctly said that mine would run four days on short circuit.

I still think that, for high E. M.F., (2.1 volts,) low internal resistance (less than half an ohm) constancy and cheapness of material, that I have A New Galvanic Cell.

TUFTS COLLEGE, Mass. A. E. DOLBEAR.

The Right to a Name.

To the Editor of The Electrical World:

SIR: The inclosed clipping from the *Indianapolis News* of Oct. 19 gives, briefly, the facts as to the suit to determine who is entitled to the trade-mark "Jenney:"

SUIT ABOUT A CORPORATE NAME.

The Fort Wayne Electric Light Company Saturday instituted suit against the Jenney Electric Company, of this city, to restrain the latter from claiming any right to the exclusive use of the word "Jenney," and to compel them to use some distinguishing term as the "Charles D. Jenney System." The outcome of this suit will be of interest as determining the value of a man's name and of his right to his own name. The Fort Wayne Company bears witness that Charles D. Jenney is the inventor of the Jenney system. It names him alone in its former pamphlets as its electrician, and speaks of the young man as having thus far invented and applied the cheapest and most perfect electric lights, etc. It seems the Indianapolis Company instructed its attorney some ten days ago to institute suit against the Fort Wayne Company to compel it to drop the word "Jenney." The Fort Wayne Company very naturally seeks to nullify the effect of the threatened suit in the manner indicated.—*Indianapolis News, Oct.* 19. 1885.

A controversy in the columns of THE ELECTRICAL WORLD is not desirable, and I write you this, not for publication as a communication, but to acquaint you with the facts, so that we may be correctly represented, if it is true, as we have been informed, that the Fort Wayne Company is seeking your columns to prejudice the case in advance. Briefly: Charles D. Jenney is in fact, and by the Fort Wayne Company's own statements in its former publications, the originator of the Jenney system.

By his recision of his contract with that company, because of its violation of the provisions of the same, and by their retransfer to him of his patents, their title to the use of his name ceased. The subterfuge of employing J. A. Jenney, or any other Jenney, to wrest from the inventor any right to share in the name which his system has made commercially valuable, cannot, we think, be maintained. We therefore, early in October, instructed our attorney, Judge Hinde, to enter suit against the Fort Wayne Company to compel it to drop the word "Jenney" from its name. That company, relying no doubt on the prestige of being plaintiff in the suit, and hoping, by claiming much, to finally get a ruling whereby it will not be denied the use of the word, anticipates our suit, and asks that in making and selling our apparatus we be required to at least employ some distinguishing term, such as the addition of the initials of Mr. Jenney's name, and that we be restrained from claiming the exclusive right to the use of the word. We do not think their course will mislead the Court nor deceive the public.

BRAINARD RORISON, Sec'y Jenney Electric Company.
INDIANAPOLIS, Oct. 24.

A Dynamo without Poles.

Among the novel forms of dynamo which have recently appeared is that of Prof. Forbes, which is exhibited at the London "Inventions." The designation "without poles" refers only to its external appearance, the magnetism being practically confined to the interior of the machine. It is designed for electro-metallurgical work, such as the deposition of copper, in which a powerful current is required. The principle upon which its action depends is similar to that of Barlow's wheel and Arago's disc, and in this respect it resembles somewhat the Delafield pipe dynamo, described by us a few months since. In Prof. Forbes' machine the magnets completely surround the disc, which consists of soft iron. It is made of considerable thickness, so as to give a good contact at the ends, and to present but very small internal resistance. The disc is completely surrounded by a soft iron shell, which is excited by an electro-magnet.

The dynamo is illustrated in perspective in Fig. 1, Figs. 2 and 3 showing the interior construction. The armature *H* is a thick disc or cylinder of iron keyed to the shaft *B*

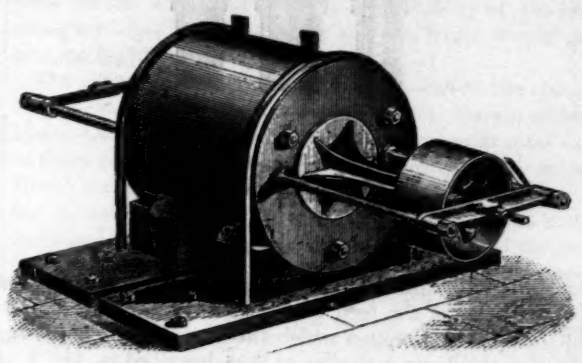


FIG. 1.—DYNAMO WITHOUT POLES.

E E are the helices of the exciting electro-magnets, and the terminals of which are at *F F*. The rest of the mass *D D* which surrounds the armature is iron. The part of the iron cylinder adjoining the shaft constitutes one pole of the machine, the periphery of the cylinder being the other pole; the current is taken off at the centre and at the

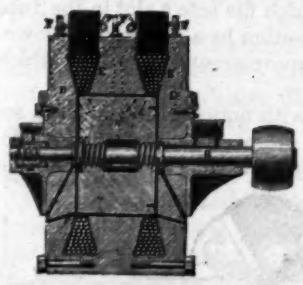


FIG. 2.

FIG. 3.

circumference of the moving cylinder *F*. Professor Forbes first tried mercury for the purpose of making contact with the exterior surface of the cylinder, but with little success. Very much better results were obtained with a solid carbon contact bearing against the periphery of the disc. This arrangement makes an excellent electrical contact without heating, even at high speeds. This has been permanently adopted by Professor Forbes, who proposes even to replace the ordinary metallic brushes upon dynamos by carbon contacts.

With a machine of this description, slightly modified, it is proposed to obtain a current of 5,000 ampères and a potential of 2 volts at 2,000 revolutions per minute. In order to get a higher electromotive force, such as is used in electric lighting, the armature instead of being a solid cylinder is built up of a series of pipes fitting one within the other, but insulated from one another. These are coupled up in series so as to give the desired electromotive force.

Prof. Bell at Work.

Prof. Bell is gradually growing out of all business pursuits, writes a Washington correspondent, and devoting himself to the improvement of the deaf. He is constantly giving more and more time to his little school on Sixteenth street, where he has perhaps a score of pupils, most all of them wholly deaf, to whom he is teaching the art of sight language. He is training these little children so that they can distinguish from the lips and face of the person speaking what they say, and teaching them to imitate the proper arrangement of the lips, teeth and tongue so that they may articulate sounds. A gentleman calling upon Prof. Bell the other evening tells me that while he was there one of his workmen came in for instructions. The man sat there for four hours, while Prof. Bell applied himself uninterruptedly to other matters which he had in hand. At the end of that time he wheeled about in his chair and began to talk to the workman. "I never heard a man talk so in my life. Every sentence had the compact result of hard thinking, and carried to the mind of the listener a complete scientific idea. In half an hour he had indicated to the man a new and great invention, and the workman said if we had known this two months ago we might have saved two months' labor. It demonstrated to me the wonderful versatility of the man who, in his far-advanced studies on the subject of sound and hearing, could pass to utterly diverse subjects instantly and with perfect mastery of each." It is understood also that Prof. Bell is at work upon the problem of resolving heat at once into electricity, a result, if it can be obtained, that will greatly simplify and cheapen all uses of electricity.

The Phelps Induction Telegraph System.

BY LUCIUS J. PHELPS.

Numerous accounts of my system of railway telegraph have been published, describing as a matter of scientific interest the manner in which it was possible to telegraph with perfect freedom to and from a moving train. But up to the present time there has been little, if anything, said in any of the public prints in reference to the practical manner in which the system could be applied and used by a railroad company, either for commercial business, or, what is far more important, the moving of their trains and the prevention of accidents such as happened upon the Pennsylvania Railroad, near New York, a few days ago.

In equipping a railroad with our system for the purpose of train dispatching, we would divide the road into sections of greater or less length, according to the amount of business done. The larger the business the shorter the section must be, or the wire would be overcrowded.

Let us take for instance the Pennsylvania road between Jersey City and Philadelphia—a distance of 90 miles. Considering the large amount of business done over that road, it would perhaps be necessary to make three sections. One from Jersey City to New Brunswick, 31 miles; another from New Brunswick to Trenton, about 26 miles, and a third from Trenton to Philadelphia, 33 miles.

We would lay our wires on each track and have separate circuits for each section. The first would have its terminal at Jersey City, and all trains between there and New Brunswick would be controlled directly from that point; the second terminal at New Brunswick and the third at Trenton, controlling their respective sections. These sub-terminals could all be connected to the head train dispatcher's office, either at Jersey City or at Philadelphia, by pole wires as the block signals are now, so that any desirable length of road could be under the special supervision of one man.

We would divide each section into blocks of say about two miles each and erect posts at the boundaries of each block, marked respectively Block 2, Block 3, etc.

Upon each train we would place a telegraph operator. Upon freight trains the conductor could perform this service, as he has little if anything to do while his train is running between stations; but on passenger trains we would put a man whose especial business it is to tend to that department and expect that the commercial business from passengers would more than pay the operating expenses of the system.

We would locate our traveling operator on the right-hand side of the baggage car, at a window through which he could observe the block posts and out of which he could display a card for the benefit of the engineer and conductor, showing the location of the train next preceding. These cards would be of tin or sheet-iron, and large enough to contain a number of sufficient size to be readily seen from either end of the train. If there were not over 100 blocks in the section four sets of numbers from 1 to 10 would be sufficient.

These cards must be placed in a rack outside the window facing both ways, so that the engineer may see it from the front and the conductor from the rear. It shall be the duty of the operator upon passing the limits of each block to report that fact to the train dispatcher at the terminal and receive from him in return a report of the location of the train next preceding, and to change his cards to correspond.

It shall also be his duty, if he sees that his train is about to enter upon the block occupied by the preceeding train, to call the attention of the engineer to the fact by a given number of pulls at the bell cord, after which, if the engineer does not slow up, he shall notify the conductor if he is near, and in the absence of the conductor it shall be his duty to apply the air brakes and stop the train.

It would probably be found advisable to arrange a speaking tube from the operator's corner to the engineer, which could be easily done so that any apparent misunderstanding could be talked over, and in any doubtful case they have direct communication with the train dispatchers.

We would compel the operator to keep a record, upon a properly arranged sheet, of his own trip and that of the train next preceding, showing the time at which each

block post is passed by each of the trains. This sheet would correspond with the train dispatcher's, and if compared after each trip will be evidence of the operator's attention or inattention to his duty.

In case of freight trains the conductor may perform this duty, and if the train is too long for cards to be seen from the engine, white and colored flags displayed at the conductor's car may be sufficient. In case of necessity, the conductor can stop the train in spite of the engineer by having the brakes applied. In a heavy fog when it would be impossible to see the rear end of the train from the engine, the conductor's car could be cut in next to the engine, and a brakeman left in charge of the rear end of the train.

The easiest thing in the world to make is a mistake, and it is a well-known fact that no one is infallible. The only perfect system of dispatching trains is one that admits of no disastrous mistakes. With this system and arrangement for operation a disastrous mistake would be an absolute impossibility.

Suppose the traveling operator in changing the cards puts in the wrong number. Its absurdity would be evi dence of the mistake, for supposing the train in advance is moving on block No. 30, the engineer knows that the next block entered by it will be 31, and if the operator should, by mistake, put out 41 or any other number the mistake shows for itself, and he can govern himself accordingly. He acts at all times intelligently and can watch the progress of the trains in advance as carefully as he watches his own.

Under the present block system, if he sees a bright light displayed over the track, it simply means that that immediate block is clear, and whether or not the operator of the block has made a mistake he cannot have the slightest idea, and he can only take his life and the lives of his passengers in his hand and dash on through the fog and darkness. If the block operator discovers his mistake a moment after the train is past (as was the case the other day) it is too late ; he may rend his hair or blow his brains out with a pistol, but he cannot recall the train which he knows is flying on to its own speedy destruction. If he was on board the train and performing similar duties it would never be too late until the final crash came, and the fact that his own life was at stake would have a tendency to remind him of his negligence.

Again, under the system which we are proposing, if the operator negligently omits to change the cards when the preceeding train passes a block, the effect is only to indicate to the engineer that the preceding train is nearer than it really is, and no harm can follow.

If he fails to report his own position on passing a block the only effect is that the record on the train dispatcher's sheet and also on the cards of the following train show his train nearer to the following train than it really is, and no harm follows.

If the operator gets drunk, or falls asleep, or faints, or is struck with the palsy, or dies suddenly of heart disease and ceases entirely to perform his duty, it will appear to the engineer of his train that the train ahead has stopped, and he will guard himself accordingly ; and to the train following, the dead man's train has apparently stopped, and he looks out for it. No harm can arise to either except perhaps a slight delay which could be quickly straightened out when all parties are in direct communication with the train dispatcher.

No lack of intelligence or stupidity on the part of the operator can cause an accident, while any neglect of duty on his part is readily detected.

But, suppose the operator in the block station dies suddenly of heart disease, or meets with any of the other calamities above enumerated? If at that moment he is displaying a bright light, indicating that the block is clear, that same indication will remain until the difficulty is discovered and another man sent to take his place, during which time the false signal only serves to lure trains on to their own destruction, A collision on account of mistaken orders or signals is impossible with this system in use and properly operated.

Diagrams of Multiple Switchboard.

To the Editor of The Electrical World :

SIR : Will you please mention in your next issue the name of a book that contains a description, with diagrams, of the multiple switchboard (not the Law). If there is no such book, where can I get the information I want? SOUTH AMERICAN.

BUENOS AYRES.

[ANSWER.—Prescott's "Bell's Electric Speaking Telephone," pages 297-308. The book can be obtained from this office, price $4.—EDS. E. W.]

"Fac-Simile" Reis Telephones.

During the past few months those interested in the great telephone litigation have given much attention to the early inventions of Philipp Reis. Discussion of this subject has involved so many scientific points that very many of our ablest scientists have been drawn into it, and will, doubtless, if they have the opportunity, further investigate the subject. The leading newspapers and journals of the country have taken it up, and the whole question seems destined, in the immediate future, to be once more thoroughly sifted. With the above facts in view, and believing that there are many educated men and thinkers who would like to know from their own experiments the approximate truth in the matter, Messrs. G. K. Milliken & Co., of Boston, have undertaken the manufacture of the necessary apparatus.

The transmitter sent us is of the "bored block" pattern, made after the original drawing in Reis' first lecture, supplemented by the model which was presented to a friend by Reis himself, and which is now in the possession of Prof. S. P. Thompson.

The receiver (knitting-needle form) is in exact concordance with Pisco's minute description, and an exact facsimile of one now held by the German government.

It must be remembered that these instruments are not offered as "practical speaking telephones," nor, indeed, is any claim made for them whatever as to their performance. They have been constructed by placing drawings, descriptions and models in the hands of skilled mechanics, with instructions to make them as nearly as possible in accordance thereto.

For those who are interested in this subject a good opportunity is here offered of procuring what is claimed to be a fac-simile of an historical instrument. The Reis instrument also makes a good addition to a physical laboratory or cabinet.

Edelmann's Medical Galvanometers.

Electrical measurement has now become as important in medical treatment as in any other branches of applied electricity, and physicians who wish to apply electrical treatment intelligently now make constant use of the galvanometer. It is apparent that the latter must be very delicate

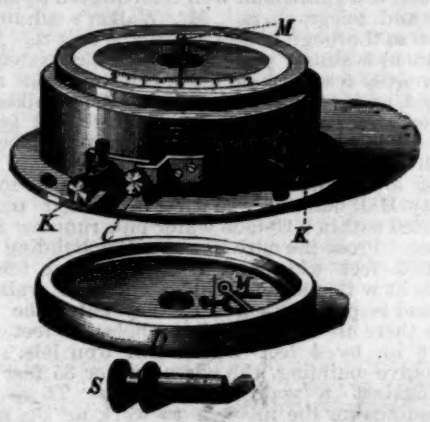


FIG. 1.—EDELMANN'S MEDICAL GALVANOMETER.

FIG. 2.—EDELMANN'S MEDICAL GALVANOMETER.

to measure the weak currents required, as a current of 30 milliamperes is rarely used, the more usual being only half that strength. Dr. M. Th. Edelmann has constructed several forms of medical galvanometers among which we illustrate two portable ones. That shown in Fig. 1 consists of a wooden box *B*, which contains the needle and is graduated at the top. Within the box there is a heavy cylinder of copper which acts as a damper upon the needle. The box also contains the galvanometer coils which terminate in the binding posts *K K*. The box also contains a coil, the resistance of which is one ninth of that of the galvanometer coils. One end of this resistance coil is connected to the binding post *K*, to the right, and the other to the metal strip *C*. The latter has a screw by which contact can be made with the binding post *K* to the left. The magnet is of the horseshoe form and carries an agate bearing upon the inside and pointer at the outside of the curvature. When the screw *C* is not in contact, the instrument measures up to three milliampères; the tenths are marked by points, but the hundredths must be estimated. When the screw *C* is in contact however, the sensibility of the instrument is increased tenfold, and reads up to 30 milliamperes. When carried about from place to place the magnet is fixed to the cover *D*, so that it may sustain no injury.

In order to meet the objection against the use of a needle resting on a pin, Dr. Edelmann constructed the instrument shown in Fig. 2. In this, the needle is suspended by a silk thread from the torsion head *S*, and the box contains in addition a coil representing the one-hundredth part of the galvanometer resistance. By this means the instrument is made very delicate, and ranges as high as 500 M. A. The silk fibre carrying the magnet can be released so that the latter rests on the bottom of the hollow cylinder of copper, and in this way can be moved about without fear of injury. These instruments have lately been imported by Messrs. Queen & Co., of Philadelphia.

The American Institute Fair.

At the American Institute Fair now being held in this city, several applications of electricity are shown. The Ozone Machine Company has one of its machines in operation, the young lady in attendance explaining its merits to the benighted public with charming grace. At the exhibit of the dry goods firm of R. H. Macy & Co., the Cleveland electric motors are employed in running a number of sewing machines.

Messrs. Waite & Bartlett have also an exhibit of their apparatus, and a large static machine discharging sparks many inches in length with loud reports. The machine is a beautiful piece of work, and draws large crowds, the public always being attracted by anything of an electrical nature to be seen in action.

Electrical Studies at Cornell.

To the Editor of The Electrical World :

SIR : Having noticed, in a recent issue of your valuable paper, a copy of the curriculum of the course in electrical engineering in the Cornell University, also editorial comment on the same, I beg leave to add something to what has already been written; partly in the way of correction, and partly to afford additional information.

The course in electrical engineering in the Cornell University was first open to students at the beginning of the university year of 1883-4; and, as reference to the university register of that year will show, was substantially as recorded in your issue of the 10th inst.

Prof. William A. Anthony, then, as now, professor of physics in that university, was chosen as Dean of the new department, and it is certainly reasonable to suppose that, in making up the course, due weight was given to his idea of what such a course should be.

Professor Thurston was at that time a member of the faculty at the Stevens Institute, of Hoboken, N. J., and it is hardly probable that he had anything whatever to do with the arrangement of the course in Electrical Engineering in the Cornell University, as your editorial would seem to indicate.

The new course was intended to comprise largely the same studies as the courses in mechanic arts and civil engineering, with the exception that for some of the more special studies of these courses special work in physics was substituted.

As to what studies such a course should include, it must be remembered that the faculty desired to provide such a course of study that they should graduate young men who were not electrical engineers merely, but educated men as well. With such an object in view, the first two years, at least, must be quite entirely devoted to what might be called foundational work.

As to the physical laboratory work of the junior year, certainly a knowledge of mechanics and acoustics and optics is of enough importance to an electrical engineer to justify a student in that course in devoting two terms of his physical laboratory work of that year in their pursuit. Again, it is found that students are not prepared to prosecute successfully advanced work in electricity and magnetism until they have completed the mathematics of the junior year.

The series of lectures suggested in your editorial for the senior year *are given* in connection with the laboratory work of that year. Those of last year, besides thoroughly considering the subject of "The Dynamo and its Applications," made an extended study of electricity as applied to the telegraph, both overland and submarine, and the transmission of electric currents, deduced the formulæ used in testing for faults in lines, explained the apparatus and methods used in locating faults in submarine cables, etc., etc.

It goes without saying that it would be better if a greater part of the four years could be devoted to the study of electrical subjects without abridging the time that should be allotted to the pursuit of other subjects in the neglect of which a thorough study of electricity would hardly be possible.

But it has been found that, after a thorough mastery of the work of the first three years of the course the student is able, by the aid of the systematic methods of the Physical Laboratory, to make very considerable progress in the study of the science of electricity and magnetism as illustrated by the experiments which he performs in the laboratory and the lectures to which he listens.

BROOKLYN, N. Y., Oct. 19, 1885. DAVID E. LAIN.

[The above valued communication is commented on editorially in this issue, but we will here remark that in THE ELECTRICAL WORLD of May 23d last an admirable article appeared on "Electrical Studies at Cornell University," from the pen of Professor Anthony himself.—EDS E. W.]

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Oct. 28, 1885.

From time to time during the past two years the question has been agitated whether or not the establishment of a central station for the distribution of incandescent lighting in this city would prove a profitable investment. A number of gentlemen prominently identified with electric light enterprises in New York and Boston have of late given the above matter more earnest and careful attention than ever before, and have ascertained to their gratification that an institution of the kind referred to is wanted in this city, and is bound to meet popular approval and support. So encouraged are the promoters of the scheme that steps have already been taken toward the installation of a 5,000-light plant. A large building on Hersey place, near Essex street, has been decided upon as suitable for the central station, and negotiations are to be immediately made for a long lease thereof. Engines have been ordered from the Armington & Sims Co., and arrangements consummated for a complete equipment of the plant. The incandescent system of the Edison Company will be used.

The Baltimore & Ohio Telegraph Company has applied for office room in the Boston Post-office, which if granted will prove a convenience to the public and facilitate the rapidly growing business of that enterprising company.

The E. Howard Watch and Clock Company will move its entire business about Nov. 1, from No. 114 Tremont street to a larger and more elegant building, corner of Washington and Franklin streets.

"The Orne battery is finding a good sale in the market," remarked Mr. Chas. L. Bly, the electrician, a day or two ago. "Since the first announcement by the Orne Battery Company in THE ELECTRICAL WORLD there has been a steadily increasing demand for the battery."

Mr. Geo. A. Mayo has installed in the Cohannet Mills, at Taunton, Mass., an incandescent plant of 150 lights, which is supplied with a dynamo of a new make, coming from the Lynn (Mass.) factory of the Thomson-Houston Electric Company. The dynamo referred to is compound wound, possesses all the requisites of a first-class machine, and has given thorough satisfaction.

The Meriden Britannia Company, of Meriden, Conn., has ordered from the Brush-Swan Company the installation of a 50-light incandescent plant, which will probably be increased to 700 lights before the holidays.

The Edison Electric Light Company, of New Bedford, has been organized under the State laws of Massachusetts. Work on the station has already been commenced, and it is claimed that by the first of December the wiring and the equipment of the plant will be finished and everything in readiness for lighting.

The Reading Electrical Company are doing a very satisfactory business, particularly in the line of call bells. The demand is very large for the continuous ringing bell made by this company, which is constructed to keep up a ringing until specially stopped, and is valuable to use in connection with burglar alarms. The enameled metal box bell, which is of fine finish and nickel-plated, as well as strong and reliable, finds a ready sale in the market. The company has a full line of other kinds of bells, comprising ordinary box-bells, skeleton bells, portable call-bells, and striking gongs of all sizes and descriptions.

The Woonsocket Electric Light Company, Woonsocket, R. I., have placed the order for the construction of their new electric light station with the Jarvis Engineering Company of Boston. The boiler and iron stack will be made by the Hicks Boiler Works, of Providence, and will be set with the Jarvis patent furnace to burn screenings for fuel. They will also use a National feed-water heater and Korting double tube injector. Sheffield grate bars, etc. The power to run their dynamos will be supplied by an Armington & Sims engine.

At the recent annual meeting of the National Electric Light Association, a committee was appointed, as readers of THE WORLD will remember, composed of representatives of nearly all the electric light systems in the country, to consider the important question of an "uniformity of prices of apparatus and service." The gentlemen who comprise the committee are as follows, viz.:

Frank Ridlon, chairman, Boston, Brush-Swan; Charles Cooper, Brooklyn, N. Y., Thomson-Houston; Geo. S. Bowen, Chicago, Van Depoele; W. A. Chase, Holyoke, Mass., Schuyler; C. B. Nooy, Chicago, Sperry; Louis Lyne, Jersey City, Ball; A. L. Ide, Springfield, Fuller; A. J. De Camp, Philadelphia, Brush; Theodore Smith, Peoria, Ill., Fort Wayne Jenney; George Guernsey, St. Louis, Excelsior. It is the desire of the chairman of the committee that the gentlemen named in the foregoing should come together, discuss, deliberate and exchange opinions on this question of most vital importance to every system of electric lighting in the country. To this end, Mr. Ridlon, as chairman of said committee, and acting in accordance with instructions received from the President of the National Electric Light Association, has issued a call to the gentlemen above named, to meet at No. 209 Washington street, Boston, on Tuesday, November 3, 1885. Several of the committee have responded to the call, and have signified their intention of being present at the place and on the date named: but there are a number of gentlemen yet to be heard from. Those who cannot make it convenient to attend the meeting alluded to, will confer a favor on the Chairman by advising him at once, to enable him to take such steps as may be deemed best in the premises.

ANSONIA, Conn., Oct. 24, 1885.

The Electrical Supply Company reports business as brisk, particularly so in its wire department. This company is experiencing a steady and growing demand for its Diamond carbon battery, which is especially adapted for domestic electric lighting purposes, such as is required for gas-lighting, call-bells and annunciators.

Mr. C. D. Warner, the inventor of Warner's electric gauge, reports a large increase of late in the orders for his ingenious and valuable apparatus. Mr. Warner has just finished his patent switch-board and regulator for use in his electric time system. It is a model of mechanical skill and artistic workmanship. This gentleman is at present engaged in perfecting several other electrical inventions, which in due time will receive mention in this paper. Messrs. Osborn & Cheesman contemplate attaching an electric clock to each loom in their braiding departments, to record the number of hours that each loom is kept in motion.

Mr. Chas. H. Nettleton, one of the most highly esteemed and enterprising citizens of this section, is installing a divided-arc-light plant of the Thomson-Houston system in the town of Shelton. This plant will supply lights for Ansonia, Birmingham, Shelton and Derby, the four towns being situated within an area of six square miles, and practically forming the town of Derby. At first only a forty-light dynamo will be put in; but as Mr. Nettleton has received assurances from a large number of manufacturers that his enterprise will receive their patronage, it is safe to predict that, to supply the demand for electric lights, both arc and incandescent, at least a half-dozen additional dynamos will have to be ordered. Mr. Henry C. Cook manufactures a very desirable small lathe, which is especially adapted for light electrical work.

Business is good with the Ansonia Brass and Copper Company. The increasing demand for the finer grades of wire for electrical and telephone purposes, manufactured by this corporation, taxes its facilities to the utmost.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
PHILADELPHIA, Oct. 28, 1885.

Since the International Electrical Exhibition was held here last year, matters in the field of electricity have been making rapid progress. The Philadelphia electricians have never been behind-hand, but the Electrical Exhibition and the handsome prizes offered to school children by the Franklin Institute and THE ELECTRICAL WORLD for the best juvenile essays on "What I Saw at the Exhibition" have so stimulated the interest among young people in electrical matters, that the reflex action is already felt, and felt on every side—from the primary schools to the laboratories; and is shown in the decided "boom" in matters electrical.

In the telegraph the greatest improvements have been made by the City Electrical Department (formerly called the Police and Fire Alarm Telegraph) and the Western Union Telegraph Company.

The chief of the City Electrical Department, Mr. David R. Walker, is a gentleman well remembered by all old electricians and telegraphers. Mr. Walker's administration has been so thorough in all particulars, that the Electrical Department is simply perfect. The entire system is soon to be removed from the old State House to the new City Hall, and, under the supervision of Mr. Walker, the removal will result in the most complete and serviceable system of local telegraph in the country. The subways through which the city's wires will run into the new building are a marvel of perfection. Approaching the new City Hall building, the wires in all their multiplicity are carried within a 20-inch water-pipe running inside the curb line. From the curb line into the building is a brick conduit 5 feet wide and 7 feet high in the crown, which is lit w th gas, and enables a man to walk through easily and inspect the wires as they enter the building. Outside there are three brick man-holes, 13 feet deep and 3 feet 6 in. by 4 feet wide, with iron lids. Entering the massive building, the wires run for 85 feet straight-away against a wainscoated wall. There will be four landings for the linemen to work up the wainscoating from the ground to the operating-room on the fifth floor, and ladders will be used to each landing. In the operating room a system of troughs 18 inches wide and 6 inches deep carries the wires in different directions. On each side of the operating room are wardrobes and desks, and rooms for the chief of the department and clerk. There are also spacious sleeping rooms for operators when off duty. The battery room is 46 feet wide by 76 feet long and 35 feet high. Here there is a series of thirty racks holding 1,500 cells of battery, insulated with Watt's patent battery insulation. The entire floor is to be covered with ½-inch asphaltum, to prevent any moisture affecting the wires. Tubs with cold water and steam are fitted up in the room for washing the batteries. In addition to the batteries mentioned, which are mostly used for the fire-alarm service, Mr. Walker proposes to introduce a dynamo for other signals.

The Western Union, in removing its main office from Tenth and Chestnut to Broad and Chestnut streets, will also make some extensive improvements, which we shall notice later on.

Mr. J. Chester Wilson, by using pure insulating material in the manufacture of Clark's underground cable, has scored quite a success. The following is a copy of a test of the "Clark Insulated Cable," made by George A. Hamilton, chief electrician of the Western Union Telegraph Company, Oct. 6, 1885, for the information of his company: Test of 500 feet, $\frac{7}{8}$ insulation, Clark wire. After 24 hours' immersion, 8,500 megohms, or about 805 megohms per mile at 72° Fahr. After six days' immersion the insulation for the piece was 11,033 megohms, or 1,045 megohms per mile at 68° Fahr.

Another very promising system of subteranean electrical communication is the "Clark Insulated." The promoters will soon be in the market with a cheaper specimen of cable for underground use than can be made of solid rubber insulation. The company has several large orders under way and reports business prospects as very promising.

The Penn Mather Company, located at No. 125 South Eleventh street, is doing a thriving business here under the supervision of Col. M. H. Alburger. Simpson's extensive yarn mill at Norristown, near Philadelphia, has been completely fitted up with this system, and the plants are spreading rapidly.

James W. Queen & Co. are in receipt of large orders from such institutions as the Massachusetts Institute of Technology, of Boston, and Yale College, all in connection with their electrical department.

Messrs. Partrick & Carter have, or are about to place, a new battery on the market. This firm publishes very complete catalogues of telegraphic supplies, as well as of burglar alarms, which they will furnish to any one who may make application. The catalogue is very full and complete, and should be in the hands of all electricians.

The Edgerton Motor Company are now manufacturing motors of one-half h. p. to 8 and 10 h. p., for street railways, to be used in experimenting in Philadelphia. They intend to procure more commodious quarters, as those now occupied are entirely too small for their rapidly increasing business.

In the way of novelties, A. F. Fleischmann is showing a wonderfully small incandescent lamp for use in illuminating rooms, hallways, etc. It is of about 1 c. p., and can be placed before the face of the clock for use during the night. They are very cheap, and Mr. Fleischmann reports large sales of them.

Another interesting novelty is being produced by the Novelty Electric Company, located at Fifth and Locust streets. It is an incandescent light for use in "The All Star Specialty" Company, now playing at Pittsburgh, Pa. It is to represent the Goddess of Liberty, and is entirely new. The actress, while singing the appropriate song, presses a button, and the light is thrown with great effect upon the stage and audience. This Novelty Company put 600 "multiplex" lights in the McCaull Opera House, and fitted the Temple Opera House and the Masonic Temple with their multiplex system.

The Philadelphia Time Telegraph Company, which uses the Hussey system, is now in the act of incorporation. This company will locate 5,000 clocks and give its subscribers free use of them for one month. After the expiration of that period monthly rentals will be charged at very moderate rates. The system is now in use in the Stock Exchange and some brokers' offices. It is the first system of this nature ever used here, and the people of Philadelphia seem to take to it very kindly. Mr. Hussey claims great efficiency for his time service.

The "Bidwell Motor" people are progressing with their experiment of an electric street railway, using the uptown tracks of the Ridge Avenue Passenger Railway Company. The indications are that Philadelphia's electric railway will be a success, and more so since the traction (endless cable) road is not doing as well as the people expected. Horses are behind the age, steam on the public streets is impracticable, steel springs will not work for ordinarily long distances, and the subterranean steel cable is not giving satisfaction here, so that there is little left for the coming generation but our own familiar electricity.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Oct. 26, 1885.

THE ELECTRICAL WORLD of the 24th mentioned the fact that two trains of cars run wholly by electricity will soon be in regular operation on the Ninth Avenue Elevated Railroad in New York, and it should also be stated that the West is not by any means behind, if indeed it is not ahead, in the preparatory work of operating electric railways. The Van Depoele Company appear to be especially active in this line. Their South Bend plant, which we have referred to heretofore, is rapidly approaching completion, and the street car company has decided to equip its whole line with the electric outfit instead of only a section, as was at first intended. This road will be a very interesting one when completed, as it will show, if it is successful, how easily all the objections which have been urged against electric roads can be overcome, and how completely all the problems involved have been worked out. Grades, curves, and switches will be encountered, and in fact the road is intended by its projectors to be a complete answer to every objection that can be advanced. It will receive a good deal of attention from street railroad people. The work on the Van Depoele electric road at the North, Central and South American Exposition at New Orleans is progressing, and the road will be ready for the opening of the exhibition, which occurs Nov. 15. This line will be one and one-half miles in length, and will run from the St. Charles street entrance to the further limits of the ground and return. It is to be put in, not as an exhibit, but for practical use, and fare will be charged for transporting passengers. Four stations will be erected at convenient points, at which tickets will be sold. The cars for this road were specially built for it by the Chicago City Railway Company, and they have already been shipped. A similar road was operated at the Toronto Exhibition by the Van Depoele Company, and so favorable an impression did it produce that the Minneapolis, Lyndale & Minnetonka Steam Railroad Company have concluded to run all their cars from the city limits to the Union Depot, a distance of two miles, with Van Depoele motors. The power will be obtained for the present from a 60 h. p. engine in the Pillsbury mills.

What we want to see is a permanent electric railroad, such as the South Bend and Minneapolis roads will be if they operate successfully, as they without doubt will. Exhibition roads are very interesting and well enough in their way, but a permanent commercial road, operated month in and month out, would give an impetus to electric railroading which cannot be obtained under any other conditions.

The Van Depoele Company are very active in their electric light department as well, and have lately made the following sales:

Eighty arc lights to the Ft. Worth, Tex., Electric Light and Power Company. Forty of the lamps will be single and forty double. The Ft. Worth Company has a fifty-year franchise.

D. L. Schreiber & Co., Cincinnati, a 20-light plant.

F. A. Whitney, Skating Rink, Cincinnati, 10-light plant.

Two 20-light plants to Plainfield, N. J.—one to Walter Scott & Co. and the other to Walter Evans, Skating Rink.

To the J. Walker Brewing Company, Cincinnati, an incandescent plant for 100 lights.

To the Lakeside Rink, Thirty-ninth street, Chicago, a 10-light arc plant.

The National Electric Service Company's electric valve apparatus for steam regulation is meeting with general favor. Among the late orders received are the following: J. J. Hagermann, residence, Colorado Springs, Col.; Mrs. D. H. Moffatt, residence, Denver, Col.; First National Bank, Denver, Col.; Indianapolis Malleable Iron Company's factory, Indianapolis; American Bank Note Company, Etna Building, New York; E. H. Johnson, residence, New York; W. E. Hales, residence, Chicago, Ill., also his office; Jno. B. Drake, residence, Chicago; G. S. Chapin, residence, Chicago.

A suit is in progress between the Fort Wayne and Indianapolis Jenney electric light companies in regard to the possession of the name "Jenney."

The Western agency of the United States Electric Lighting Company is enjoying the largest business in its history, having $240,000 worth of contracts in hand at the present time. Incandescent work predominates somewhat, though a good many arc light plants are being sent out. Among the latest orders of the company is a 300-light incandescent plant for the Centropolis Hotel, Kansas City.

The electric light department of the Union Switch and Signal Company have lately made the following sales: Monongahela House, Pittsburgh, 700 16 h. p., and 50 150 c. p. Stanley lamps, gas to be entirely excluded from this hotel; Pittsburgh Club House, 250 25 c. p. Stanley lamps.

The Westinghouse Air Brake Works and the Philadelphia Natural Gas Company's Works are also being fitted up with this apparatus.

SOUTHWESTERN NOTES.

KANSAS CITY, Oct. 26, 1885.

The Pacific Mutual Telegraph Company has lately strung a new No. 6 wire between Kansas City and St. Louis, and I believe that in connection with their ally, the Bankers and Merchants' Company, it is their intention to continue this wire to Chicago at an early day. The section just completed was tested by the long-distance telephoning last Sunday week. Messrs. Meyers, McDaniel, Crandall, Burrett, and other local electricians were in attendance at the Kansas City end, and the officers of the telephone and telegraph companies at the St. Louis end. Mr. Meyers, superintendent of the Pacific Mutual, gives the length of this wire at 320 miles, and all present testified to the clearness of the signals, and the ease with which they could distinguish their friends' voices at the other end. There chanced to be a thunder-storm at the time, and this in a measure interfered with the experiment. It also interfered with the amusement of some of the party. Mr. Crandall happened to have the telephone to his ear when a flash of lightning came in on the wire, and the shock he received caused him to drop the instrument without any premeditation and retire to the other side of the counter. During the rest of the exercises he was simply an attentive observer—at a distance.

The Missouri and Kansas Telephone Company have started out two different construction gangs on territorial line extensions this week. One gang is to build a second line, by a different route from the present one, between this city and Leavenworth. The large increase of toll line business between these two points makes a second route imperative. The other gang goes to Wichita to build a line 65 miles in length connecting that town with Wellington, Winfield and other important points in that part of Kansas. This is to be an experimental line. It is to be built of gas pipe instead of poles. The pipe is 1¼ inches in diameter, and the length is 20 feet—3½ feet in the ground, and 16½ feet clear. It is proposed to dip the pipe in a boiling mixture of coal tar to keep it from rusting. The wire for these two lines, as well as for all other territorial lines, is to be built by this company in the future, and will be No. 14 hard-drawn copper wire. Supt. McDaniel informs me that the following extensions, in addition to the above, are under consideration, and will undoubtedly be built this fall: Topeka to Burlingame, 25 miles, new line; Ottawa to Pomona, 12 miles, new line; Hannibal to New London, 11 miles, old line to be rebuilt. All this will be cedar poles and No. 14 hard-drawn copper wire. This company has also entered into a contract with the police commissioners of Kansas City to build a circuit for a city police call wire, similar to the system now in use in Chicago, St. Louis and other cities. Provisions are made at first for 10 boxes, but no doubt more will soon be added when the usefulness of the system is demonstrated. Mr. W. W. Smith, general superintendent of this company, returned recently from a week's trip to Indianapolis and Chicago, where he has been watching the case of the Indiana subscribers against the Central Union Telephone Company and vice versa.

The main office of the Bell Telephone Company of St. Louis was partly burned out the other night. The cause is said to have been contact with an electric light wire which set the cupola on fire and so communicated it to the Exchange. This is another strong argument against the practice of putting these two classes of wire in close proximity. Not only does it endanger the telephone company's plant, but it is liable to set any subscriber's residence or place of business on fire. Electric light wires should be "quarantined" like the small-pox or cholera.

Mr. J. E. Bonebrake passed through the city last week on his way to his home in Abilene, Kan., where he will construct an extensive electric light plant to light the whole town by the Edison incandescent system. Meetings have been recently held in Abilene in order to form a gas company, and Mr. Bonebrake, at one of the meetings, made the proposition that he would light the town with electricity, merely as a private enterprise, and stated that it should cost the city no more than equal service given by gaslight. Mr. Bonebrake has just returned from St. Louis, where he has completed arrangements for obtaining the plant, and work will be commenced very soon. He will light not only the streets, but also business houses and private residences.

DYNAMO.

THE TELEGRAPH.

A Cable Repaired.—The Southern cable of the Commercial Company has been repaired by the "Faraday," and is now working again.

Cable Dividend.—The United States Cable Company has declared a dividend of three per cent. for the quarter ended Sept. 30, a decrease of 2 per cent. from 1884.

Economic Ventilation.—The operators at the Western Union Building, 195 Broadway, complain very bitterly of the bad ventilation of the operating room, and assert that great improvement might be made if the company were not so anxious to economize.

Color-Blind Operators.—Dr. Hedrick has been engaged by the Baltimore & Ohio Railroad to go over the entire lines of that company and examine all telegraph operators in the company's employ for color-blindness. All those who fail to pass the examination will be removed.

New Wires Under the Hudson River.—The Gold & Stock Telegraph and Metropolitan Telephone companies are laying new cables across the Hudson from the foot of York street, to replace those destroyed by the fire at the Red Star docks. The new cables will be seven in number, and will be dropped into the water direct from the cable-house instead of being strung along the pier to the end as before.

More Figures Wanted.—It is to be regretted that the Western Union Company has never seen fit to furnish fuller details of a purely statistical nature regarding the telegraph business. In a corporation occupying such an important relation to the whole country this is all the more unpardonable. It is, perhaps, only to be explained on the ground of the predominance of a speculative spirit in the management.—*Bradstreets.*

Commercial Telegram Stock. — The *Miscellaneous Security Report* says: The stock of the Commercial Telegram Company is quoted at about 16 per cent. It should be worth more. This company owns the improved ticker patents of Mr. Stephen D. Field. The company has quite an extensive plant in successful operation in this city and Chicago, and its sub-company, the Financial Telegram Company, will soon have a large number of instruments at work in Boston.

Greater Facilities Wanted.—A petition bearing the names of all the business men in Peterboro', N. H., 75 or more, has been forwarded to the Western Union Telegraph Company, asking them to open an office in that town. The poles were set last spring and the wire was placed in position, and there the matter rests. The American line is only an independent branch from Keene through Dublin, Harrisville and Peterboro' to Nashua, and all messages to stations beyond Keene and Nashua are charged double rates. If the company neglects to provide an office after erecting the line, and compels those who would gladly avail themselves of the privilege of using it to pay this rate, measures will at once be taken to seek a remedy.

New English Service.—On the first of the month a reduced rate for telegraphing went into effect in England. By the new arrangement the charge is sixpence for twelve words or less, and a halfpenny per word above twelve. Every word, including the address, is charged for, but a change in the method of counting is made which partially effects this. Thus names of towns or villages, as "South Boston" or "West Lynn," would be counted one word; under the old rules the same names would have been charged two words. Figures, which were counted as one word each, will be counted at the rate of five figures to a word. Under the old system "344 Sumner Street" would have been five words, but under the new is only three. Initial letters are charged for as words except in some few instances, like the London district initials, which are counted as one word for the two letters.

"Specials."—So much has been said about the new newspapers that have been started in this and other cities during the past year, that many people supposed that there was a very large increase in the number of words sent by wire. This may be true, but if so, the Western Union hasn't got the extra business, as a report recently issued by the company shows no material increase in the number of "press" words sent. It may be that the Baltimore & Ohio company got the extra work, but the impression here is that the new newspapers made their special efforts in their local work. One thing is noticeable—the cable service. Never before have so many words been flashed under the sea as during the past year. The cable is more used now than ever before, not only by newspapers that print over a column of special cable dispatches a day, but by bankers, brokers and merchants, who, instead of cabling a few words a day, send dispatches in great detail.

THE TELEPHONE.

A Pan-Electric Exchange Busy.—The *Mirror*, of Fort Worth, says: "The Pan-Electric Telephone Company is running 100-wire cables from the central office."

Output of Instruments.—The output of the Bell Telephone Company for the month ending Oct. 20 was 2,679 instruments, and the returns 3,730, making a net loss of 1,051 instruments. This contrasts with a net output of 169 for the previous month.

A Telephone Toilet.—"Malinda, I'm astonished at you—standing at the telephone with your hair in papers and your collar crooked." "Why, mother, I don't see why that should matter." "O, of course you don't! You never *did* care how you look. How do you know who's at the other end of the 'phone?"

In Kansas.—Mr. James S. James, General Manager of the Crawford County (Kansas) Telephone Company, reports as follows from Girard, Kansas: "The company has a line almost completed to Pittsburg, Kansas. It will be ready about Nov. 1. It is twelve miles long, is built with No. 12 steel galvanized wire, and is to be used for toll purposes."

The Telephone in Medicine.—A recent interesting exhibition of apparatus in Paris, by Dr. Boudet, included modification of the telephone adapting the instrument to a variety of medical uses. In one form the pulsations of blood vessels and all sorts of internal operations were very strikingly made audible, the observer being able to hear at will the movements in any part of the body. Another telephonic appliance detected the presence of stones in the bladder, and even made known their character when present. Dr. Boudet also employs the telephone as a measuring instrument for accurately estimating the nervous and muscular excitement in the different phases of a disease.

Patent Litigation.—Three petitions have been presented to the Department of Justice, asking that suits in equity be brought to vacate the Bell patents now owned by the American Bell Telephone Company. Two of these petitions were presented by the Globe Telephone Company and the other by the Washington Telephone Company. The Department of Justice has referred the petitions with the accompanying papers to the Department of the Interior. Secretary Lamar directs that all the interested parties shall appear before him and the Commissioner of Patents and exhibit all the facts and answer whether the government has the right to institute and maintain such a suit for such a purpose, and if it has, do the facts as they shall be presented warrant or demand that such suit be brought.

Discordance in Concord.—The removal of telephones continues as fast as the men can take care of the instruments, the number thus far taken out being 124. This leaves 103 still in use, and the lessees of 25 of those are signers of the remonstrance. Of the remaining 78 probably 30 will be ordered out on the first of November, leaving less than 50 controlled by this exchange. It is hardly probable that the exchange will run for so small a number of patrons, and unless some arrangement is made in the meanwhile, it will not be surprising if it is permanently closed. The decline of the telephone in this city is even more sudden than its rise. The exchange was first opened here in May, 1881, at which time there were but 13 instruments in use. It grew rapidly in favor until a total of 227 instruments was reached, and the prospects were good for a still further increase at the time of the advance of rentals, and consequent trouble.—*Concord, Mass., Monitor.*

The Man He Wanted.—A good story is told of Col. Parker, superintendent of the Boston division of the New England Telephone Company, who was formerly chief inspector in the Post Office Department at Washington, and had been a detective in the post office service for many years previous. On one occasion, in his earlier days, he was set to catch a defaulter who had decamped with thirty or forty thousand dollars of government funds. The Colonel learned that the man was a victim of the use of opium. He therefore visited many towns and cities in the State of Virginia in which the offense occurred, and inquired at drug stores for a man who had been in the habit of buying small quantities of opium at regular intervals, the Colonel's reasoning being that the fugitive did not dare to purchase the drug in large quantities for fear of taking an overdose in a moment of temptation. At last a trace of the man was obtained in a rural town, from which he was subsequently tracked to Richmond. Cautious inquiry among the apothecaries of that city resulted in the discovery of one from whom a stranger had been purchasing small quantities of opium with great regularity. In this way the offender was captured.

THE ELECTRIC LIGHT.

Augusta, Me.—The new cotton mill of the Edwards Manufacturing Company will be lighted by electricity.

A New Station.—The Woonsocket Electric Light and Power Company have purchased a lot 40x65 feet on Bernon street for the erection of a building to be used for their engine and dynamo purposes.

Boilers for Plants.—The Heine Safety Boiler Company, of St. Louis and Chicago, have recently sold a boiler to the Western Edison Light Company, for the Forest City Electric Light and Power Company, at Rockford, Ill.

To Furnish Both Kinds.—The Schenectady Gas Company, Schenectady, N. Y., have decided to put in an electric light plant in connection with their gas business. In the near future we may expect to see a more frequent combination of these two interests for supplying light to the public.

Fort Worth, Tex.—The charter for the Fort Worth Electric Light Company was filed at Austin recently. The incorporators are: J. W. Andrews, N. Wallerich, W. H. Little and R. E. Maddox. The charter runs for fifty years. An 85 horse-power engine has been ordered for the plant; system not stated.

Greeley, Col.—Greeley, Col., is not behind the times on the subject of light. A company has been organized to introduce the electric light, the necessary capital is raised, and negotiations are now pending for a 600-light incandescent plant. It will be used for street illumination, and for stores and private houses. It is expected to have the same in operation by the first of December.

New Bedford, Mass.—The Jarvis Engineering Company, of Boston, have received the contract to furnish the steam plant for the new Edison Lighting Company, of New Bedford, Mass. They will put in two Armington & Sims engines, two 6 × 16 steel tubular boilers set with the Jarvis furnace, National feed-water heater, Davidson steam pump, Korting injector, etc.

One Result of Seeing Fargo.—One thing was demonstrated to the writer at Fargo last week; *i. e.*, the electric light is a great benefit to a city, and as Aberdeen has power sufficient and to spare, in the artesian well, to operate the machinery for the electric light, we believe that the common council would be justified in supplying our city with an electric tower and a number of lights.—*Aberdeen Pioneer.*

Baltimore, Md.—Articles of incorporation were filed recently of the Excelsior Electric Light Company, of Baltimore City, with John Q. A. Holloway, John W. McCoy, William A. Hanway, Sebastian Brown, all of Baltimore, and William H. Schock, of Washington, D. C., as incorporators and directors. Capital stock $300,000 in 3,000 shares, of $100 each. The object is the manufacture and sale of electricity for lighting and power.

A Fine Catalogue.—We have received a very handsome illustrated catalogue of the "Technomasio Italiano" of Messrs. Cabella & Comp., of Milan. They show a great variety of dynamos for lighting, and various arc and incandescent lamps with all the necessary fittings. Electrical instruments in considerable variety are also shown. The catalogue is very complete, and is far superior in artistic appearance to almost all the other foreign ones which we have seen.

In Breweries.—The big Bechtel brewery on Staten Island is lighted by arc and incandescent lamps of the Weston system. It is now reported that Rubsam & Hormann's brewery on Staten Island will also soon be lighted by electricity. Among the advantages are the absolute safety, absence of heat and great body of light; while by means of a flexible cable lamps may be taken in casks when varnishing the inside, without fear of explosion. The New England Weston Company is making a specialty of brewery lighting.

Bellows Falls, Mass.—One of the things for which Bellows Falls people are largely indebted to the extensive paper manufacturers of the locality, which gives to the town an additional advantage over larger places in the State, is the electric light, which is furnished the village merchants and others for a mere song, as it were. The Fall Mountain Company furnishes the power for no less than 800 electric lights, 400 or 500 of which are used in the company's different mills and the balance by the village storekeepers and others, who are charged but 1 cent an hour for the use of each light, which is of 16 candle power. These lights give such general satisfaction that it seems quite likely that within a few months the plant will be so extended as to furnish many of the village dwellings with a light which it is claimed by those now using it is cheaper even than kerosene.

APPLICATIONS OF POWER.

Extension of an Electric Railway.—The electric railway, which has been in operation since April, 1884, between Moedling and Brühl, in the suburbs of Vienna, is about to be extended to Hinterbrühl; its length will thus be increased from 3 to 4.5 kilometres. The system adopted is that of Messrs. Siemens, by which the current is produced at a fixed point and transmitted to the motors of the cars by metallic conductors along the route. The power is

at present generated by five dynamos, each giving 30 ampères, with a difference of potential at the terminals of 500 volts.

MISCELLANEOUS NOTES.

Very Fine Wire.—We have lately seen a beautiful sample of No. 47 copper wire, insulated, diameter .002 of an inch. It is made by the American Electrical Works, of Providence, R. I., who must be congratulated on this remarkable specimen of their skill in wire drawing and insulating.

Protecting the Washington Monument.—A dispatch of the 16th inst., from Washington, says: The lightning rod tips, and the rods to which they are to be fixed, intended to protect the Washington Monument from lightning, have arrived from Philadelphia, where they were made, and are now being placed in position. The construction of scaffolding around the roof was timed so that it would be in readiness when the rods should arrive, and there will be no delay in the work, except that caused by bad weather. The apparatus constructed in Philadelphia consists of 704 feet of triangular copper rods, plated with gold, to encircle the roof in the horizontal points; 200 feet of circular copper rods, also gold plated, to extend along the four corners of the roof, and 172 lightning rod points. The latter are three inches long, made of copper, and gold plated, with the exception of a half-inch at the end, which is of platinum. These 172 points, together with those erected immediately after the monument was struck by lightning, made 200 points in all, nearly covering the roof of the monument. In the opinion of the scientists who made the recommendations, these precautions will protect the monument from lightning in the future.

Detective Work with Camera.—Curious evidence has been obtained by a member of the Property Owners' Association, now engaged in an attempt to clear vice out of the mercantile portion of Sixth avenue, New York. He has used a camera to some purpose. The rotten neighborhood is brilliantly lighted at night by electricity. The city's street lamps there are electrical, and these are re-enforced by those hung in front of saloons. The interiors also of the dance-houses, concert gardens and variety shows are glaringly illuminated. Armed with a pocket camera for taking instantaneous views, he has made over a hundred negatives, the prints from which show the character of the nuisances beyond the possibility of contradiction. In every case the camera was used after 1 o'clock in the morning, when the sale of intoxicants is supposed to have stopped. The street scenes, showing throngs of men and girls entering and emerging from the doorways, were obtained without difficulty, for only a second's exposure of the lens, like the flash of a dark lantern, was required in each case. Sixty of these were made without attracting any attention. Then he undertook the more delicate job of interior photographing. He got eighteen covert shots from the galleries and private boxes of the Haymarket, San Souci, Prospect, Alhambra and Coffee's, all in the region of retail shopping. It is expected that juries will believe the pictures against all denials.

BUSINESS NOTICES.

Washington, D. C.—The United States Electric Lighting Company, Washington, have ordered a second tubular boiler, to be set with the Jarvis Patent Furnace.

Well Earned.—The Armington & Sims Engine Company, of Providence, R. I., have been officially advised that a gold medal has been awarded them for their excellent engines, by the judges of the International Inventions Exhibition in London.

Anti-Magnetic Shields for Watches.—These shields, made by Giles, Brother & Co., State and Washington streets, Chicago, are an efficient protection to the works of watches from magnetism, as many testimonials in their possession show. This firm also demagnetize watches that are already affected. The Eastern Agent is W. A. Wales, 16 Maiden lane, New York.

Card from the United States Electric Lighting Company.—Special attention is called to the foot-note of the Edison Company's advertisement, which has been running since August 15 in this paper, in which they give us a gratuitous notice in their conspicuous attempt to mislead the public. The Chicago *Times* of August 9 read as follows: "The last statement issued by the United States Electric Lighting Company develops the fact that during the past year over **53,100** incandescent lights were installed or contracted for by that company, instead of 3,100, as stated in yesterday's *Times*." The Edison Company seem to be clutching at treacherous straws.

Pike's Toothache Drops.
Buro in 1 minute; harmless, quick, thorough; no equal; 25c.
DEAN'S RHEUMATIC PILLS are a prompt, sure cure; 50c.
HALE'S HONEY, the great cough cure, 25c., 50c. and $1.
GLENN'S SULPHUR SOAP heals and beautifies the skin; 25c.
GERMAN CORN REMOVER kills corns and bunions; 25c.
HILL'S HAIR AND WHISKER DYE, black and brown; 50c.
GERMAN CORN REMOVER kills corns and bunions; 25c.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Cable, b 65, a 70; Am. Dist., a 29½; Western Union, b 75, a 75¼.

Telephone.—Am. Bell, b 176, a 177; Erie, b 26, a 26½; New England, b 29, a 30.

Electric Light.—No new quotations.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

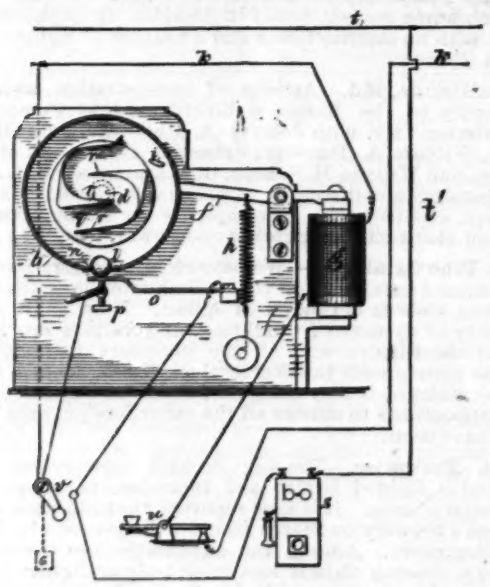
PATENTS DATED OCTOBER 6, 1885.

Railway Signal; William A. Murray, Piako, New Zealand 327,962
Provides levers and ratchets and ratchet-wheels along the track, and a hinged lever supporting a wheel upon the train, so that the lowering of the latter operates the former, and completes a circuit to give a signal of the approach or recession of a distant train.

Electrical Conductors; James Tatham, Philadelphia, Pa..... 327,971
Consists in enveloping the insulated wire in oil or other liquid insulating material up to the point of application of the hot metal thereto.

PATENTS DATED OCTOBER 13, 1885.

Electric Annunciator; Arthur E. Briggs, Bond Hill, O..... 327,997
A stirrup-shaped shield carrying an armature is pivoted



328,148. SIGNAL AND CALL APPARATUS.

below its centre of gravity in the rear of the pole pieces. The shield is the annunciator signal.

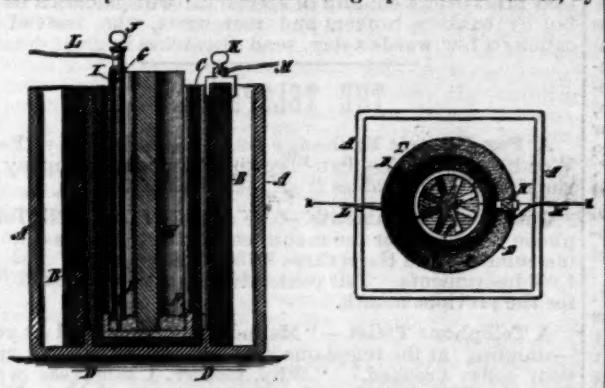
Conduit for Wires; Henry F. Cox, Philadelphia, Pa..... 328,012
He has a claim upon wooden containing pipes supported at each end on stakes and secured to said stakes by metallic bands passing over and protecting the joints.

Electric Arc Lamp; Alexander Fyfe and John Main, Brixton, England..... 328,022
Consists of an intricate combination of fly and detent wheels, tooth and friction gearing and suitable brakes operated in such a manner that ratchet gearing operates the carbon carrier.

Time Signal Transmitter; John M. Oram, Boston, Mass..... 328,055
It is an improvement upon Letters Patent No. 287,710 dated October 30, 1883. The transmitter and its motor are connected positively by gearing which is started and stopped by the regulating-clock through the medium of an electro-magnet.

Electric Signal and Call Apparatus; Carlos A. Smith, Brooklyn, N. Y., assignor of ¼ to M. S. Frost and Son, New York, N. Y..... 328,148
Consists, as shown in the cut, of two or more dial-boxes *b*, one at each station, an electro-magnet *g* and armature *f* to rotate the same, a weight *l* within each dial-box, a circuit-closing spring acted upon by the weight, and a second electric circuit passing through the circuit-closing spring, and containing a telephonic or other electrical instrument.

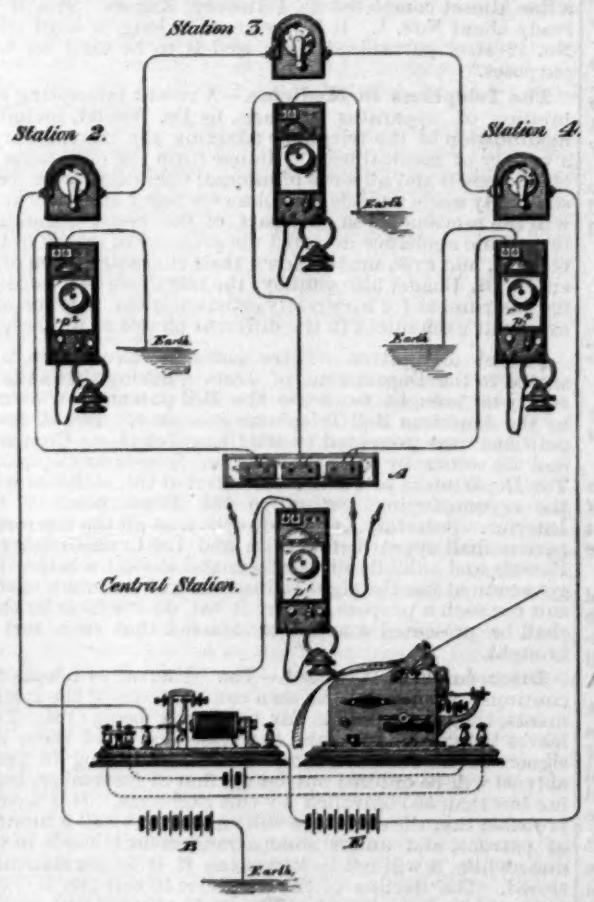
Electric Temperature Regulator; Charles A. Tucker, Islip, N. Y..... 328,156
Alternate slats are of glass and fixed; the remainder of brass and pivoted; the latter being operated as valves, by



328,208. GALVANIC CELLS.

an electric device, which in turn is operated by a thermostat.

Alarm; Gwilm N. Williams, Wilkesbarre, Pa.... 328,166
Consists of a swinging keeper for a bolt or latch, and a



328,305. TELEPHONE EXCHANGE SYSTEM.

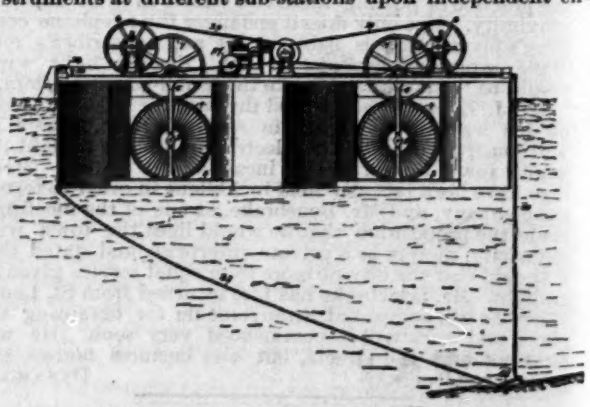
locking lever operated by an electro-magnet and the necessary battery and connections for making and breaking circuit and means for releasing the keeper.

Electric Telethermoscope; Frederick W. Flint, Atlanta, Ga..... 328,205
The thermostat, comprising the novelty of the invention, consists of a fluid supporting a pivoted lever adapted by its movements to close a circuit.

Galvanic Cell; Ernest M. Gardner, Boston, Mass., Assignor to James L. Little, Jr., of same place..... 328,208
Consists of electrode *E*, porous carbon cup *C*, inner vessel *F*, of non-conducting material, containing mercury, and conducting-rod *G H*, provided with a non-conducting coating *I*, and a negative electrode *B*.

Dynamo-Electric Machine; Edwin R. Rice, Jr.... 328,253
Consists in making an equalizing connection between two or more machines at that part of the machine circuit between the armature-circuit and the direct field-magnet circuit or field-coil in direct connection as distinguished from derived connection with the feeding-mains.

Telephone Exchange System and Apparatus; Leroy B. Firman, Chicago, Ill., Assignor to the Western Electric Manufacturing Company, of same place..... 328,305
Consists of signal-transmitting instruments at different stations and a common signal-receiving instrument at a central station upon one circuit with a signal-transmitting instrument at the central station and signal-receiving instruments at different sub-stations upon independent cir-



328,418. CURRENT MOTOR FOR DYNAMOS.

cuits radiating from the central station, as shown in the cut.

Current Motor for Dynamo-Electric Machines; William Main, Brooklyn, N. Y., Assignor to the River and Rail Electric Light Co., Ohio County, W. Va..... 328,418
Consists of a floating support anchored in the stream, a dynamo-electric machine mounted on the support and driven by water-power mechanism, a flexible cable for conveying the current of said dynamo to shore, and means for regulating the draft of said floating support, whereby the immersion of the water-power mechanism in the current may be governed at will.
The details are shown in the cut.

Electric Railway; James F. McLauchlin, Philadelphia, Pa., Assignor by mesne assignments to the National Electric Railway System (Limited), of same place..... 328,420
The cars run, any number at a time, by the use of a small conducting wire and small current, the current being intermittent, so that not all the cars are in circuit simultaneously.

Apparatus for Utilizing the Current Force of Water; Edwin L. Brady, Stamford, Conn., Assignor to the River and Rail Electric Light Company, W. Va..... 328,447
He has a broad claim on the combination of a storage battery and a dynamo, the latter being operated by water-power mechanism supported upon a floating vessel in a stream of water.

Copies of any of the Patents mentioned in this Record can be obtained, with full specifications and drawings, from this office on application; price twenty-five cents each.